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UNITED STATES PUBLIC HEALTH SERVICE

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Public Health Reports

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ILLNESS AND ACCIDENTS AMONG PERSONS LIVING UNDER DIFFERENT HOUSING CONDITIONS *

Data Based on the National Health Survey

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I. INTRODUCTION

With growing national interest in housing, expanding Federal and local programs of slum clearance and rehabilitation, and an upswing in public and private building construction, more and more attention is being paid to the relation between housing and health. That substandard housing and a low level of health will be found together goes almost without saying; but the measurement of this association and of the specific directions it takes are fraught with difficulties. Winslow, DallaValle, and Britten, among others,[1] have already pointed out how extremely difficult it is to evaluate the effect of poor housing per se on health. Innumerable other factors, chiefly economic and sociological, are so deeply involved in the subject that their effect can at best be only partially eliminated. Hence, this paper and others of its type must be confined to tracing the association between health and housing without attempting to establish with any finality the degree of responsibility that housing itself has for poor health.

*From the Environmental Sanitation Section, Division of Public Health Methods, National Institute of Health. Acknowledgment is made to various members of the Division staff for assistance in the preparation of this article. The authors are particularly grateful to Dr. J. M. DallaValle and Mr. James S. Fitzgerald for technical and editorial assistance. Assistance in the preparation of these materials was furnished by the personnel of Work Projects Administration Official Projects Nos. 712159-658/9999 and 765-23-3-10.

[1] Britten, Rollo H.: The relation between housing and health. Pub. Health Rep., 49: 1301-1313 (1934).
DallaValle, J. M.: Some factors which affect the relationship between housing and health. Pub. Health Rep., 52: 989-998 (1937).
Winslow, C.-E. A.: Housing as a public health problem. Am. J. Pub. Health, 27: 56-61 (1937).
Britten, Rollo H.: Housing and health. Am. J. Pub. Health, 28: 957-960 (1938).

Items enumerated in the National Health Survey [2]—amount and nature of illnesses experienced in the household during the 12 months immediately preceding the enumerator's visit, annual family income and relief status, ages of the household members, number of rooms in the dwelling unit, its monthly rental or estimated value, and kind of toilet facilities present—make possible a fairly detailed study of some aspects of this association. Some of the major findings have already appeared in an introductory paper.[3]

The comparisons in this report are confined to the urban data and to the white population.[4] With the exception of two tables (tables 3 and 4) concerned with illnesses from which a person was disabled on the day of the enumerator's visit, the data are restricted to illnesses disabling for 7 consecutive days or longer.[5] A disabling illness was defined as one that kept a person from his usual activities—work, school, care of the home, or other pursuits—by reason of disease, accident, or physical or mental impairment.

II. ILLNESS AND CROWDING [6]

In a comparison of illness rates at different crowding levels, degree of crowding is to be considered as standing for housing quality generally; that is to say, congested households will tend to be poorly housed in other respects also, and will tend to be representative of the neighborhoods in which they are most likely to be found, in slums and blighted areas. It follows, however, that crowding is also a crude

[2] A previous article (Perrott, G. St. J., Tibbitts, C., and Britten, R. H.: The National Health Survey: Scope and method of the Nation-wide canvass of sickness in relation to its social and economic setting. Pub. Health Rep., 54: 1663-1687 (1939)), has already described the scope, method, and purpose of the National Health Survey, a project conducted by the United States Public Health Service during the winter of 1935-36, in which some 2,500,000 persons in 700,000 households were covered by the house-to-house-canvass method in 83 cities in 18 States. (The National Health Survey also covered about 140,000 persons in 37,000 households in 23 rural areas.) The total urban surveyed population was so distributed as to give a sample which was, in general, representative of cities in the United States according to size and region. In large cities (100,000 population and over) the population to be canvassed was determined by a random selection of many small districts based on those used in the U. S. Census of 1930. In the smaller cities selected for study, the population was enumerated completely.

The Health Survey schedule is reproduced in the article just cited. The article also contains explanations of many of the terms employed in the present report, of which only the most pertinent will be repeated.

[3] Britten, R. H., Brown, J. E., and Altman, I.: Certain characteristics of urban housing and their relation to illness and accidents: Summary of findings of the National Health Survey. Milbank Memorial Fund Quarterly, 18: 91-113 (April 1940).

There will be certain discrepancies between the data presented in the introductory paper and in the present one, owing to the fact that here the data have been further refined by adjustment to a standard age and household-size composition. (See pp. 612-613.)

[4] Except for the inclusion of colored persons in the section on home accidents, where no breakdown by color was made.

[5] Confinements, hospital cases, and fatal cases of any duration are included in the definition. The number of cases in these categories which disabled for less than 7 days constitute a nominal portion (2.3 percent) of all illnesses coded as disabling for a week or longer.

[6] A detailed description of the characteristics of the health survey population with respect to crowding will be found in Britten, R. H., and Brown, J. E.: Urban housing and crowding: Relation to certain population characteristics as indicated by National Health Survey data. Pub. Health Bull. No. 261. U. S. Government Printing Office, 1941.

For data classified by city, see Adequacy of urban housing in the United States as measured by degree of crowding and type of sanitary facilities. National Health Survey, Preliminary Reports, Sickness and Medical Care Series, Bulletin No. 5, Division of Public Health Methods, National Institute of Health, U. S. Public Health Service, Washington, 1938.

measure of economic status, the inverse correlation between income and crowding being high. In most of the tables that follow the effect of income is partially eliminated by making comparisons of illness rates within fairly specific income groups.

Degree of crowding as an index of the quality of housing has one further limitation that should be pointed out: Overcrowding among higher-income groups, say above the $1,500 level, can hardly have the same significance as in a group which has not the means to supply itself with decent housing. To overcome this limitation, attention is centered upon the lower-income groups.

Crowding, with "persons per room" as its measure,[7] is for the purposes of this report divided into three categories: One person or less per room, more than one person per room but not more than one and a half, more than one and a half persons per room.[8] For convenience, these categories are referred to hereafter as *A*, *B*, and *C*, respectively; and, to facilitate comparisons among these three degrees of crowding, ratios of the rates in categories *B* and *C* to those in category *A* are presented in most of the tables on crowding and illness, with the rate in category *A* expressed as 100. From appendix table 1, in which the population used in the sections of this paper on crowding is classified by economic status,[9] age, and degree of crowding, the distribution of this population among the three categories may be readily computed. Thus, for all incomes and ages the percentage distribution was:

A. One person or less per room	74.9
B. More than 1 person per room but not more than 1½	16.7
C. More than 1½ persons per room	8.3
	100.0

As was stated in the introductory article referred to (see footnote 3), it is important to emphasize the fact that the degree-of-crowding classification is employed with no intention of fixing an exact line of demarcation between crowded and uncrowded households. If an attempt were made to establish such a line of demarcation, certain

[7] The number of persons per room, which was calculated separately for each household, is the ratio of the total number of persons in the household to the total number of rooms in the dwelling unit or abode in which the household resided. In determining the number of rooms, kitchens were included; baths, basements, and attics not used for living quarters were excluded.

The *household* in the Health Survey was a group of persons (or one person) living in a dwelling unit such as a house, apartment, rooming house, dormitory, nurses' home, or room or suite in a hotel. The household included all persons who resided (slept) in the abode. *Family*, as used in reports of the National Health Survey, refers to the group of members of the household related to the head.

The population and the cases of disability occurring in this population were, for reasons of tabulation, actually classified by size of family. But differences resulting from classifying by size of family instead of by size of household were negligible, especially in view of the types of households excluded from this portion of the study. (See p. 612.)

[8] Households with eight or more members in which the number of persons exceeded the number of rooms by one have been classified in the group with one or less persons per room.

[9] For the purposes of this paper, all persons living in a household were classified according to the total income of related members for the 12 months preceding the interview, except that persons in households where relief had been received were classified simply under "Relief." Again reference is made to definitions given in the paper cited in footnote 2.

factors in addition to persons per room would have to be taken into consideration. Among other factors involved, for instance, are size of rooms, size of the household, and the age and sex composition of its membership. It might also be pointed out here, since crowding is being used as an index of the quality of housing generally, that there are a multitude of families who, while not living in congested quarters, are badly housed because of inadequate toilet facilities, dilapidation, dampness, lack of heat, and so on.[10]

For reasons of tabulation, the data are confined to persons in households consisting of at least the household head and his wife. The white population in households containing both the head and his wife was approximately 1,841,000.[11] The suggestion is made that since the home living space required by a household depends in large measure on its composition, by making this exclusion the more or less usual types of families are being studied.

A further exclusion has been made in the consideration of all illnesses combined; persons for whom a confinement or illness associated with pregnancy or childbirth was recorded were excluded from the population base, and all types of cases for such persons were also excluded. Since the crowding index was calculated as of the day of the visit this type of exclusion was desirable to eliminate the effect of a change in the crowding status of these persons by reason of the birth itself. Appendix table 2, where the number of persons affected is given by economic status and degree of crowding, shows that there were 31,263 such persons.

Age composition and household-size composition varied so much from one degree-of-crowding category to another [12] that it is virtually

[10] The fundamental requirements of a healthful home environment are set forth in: Basic principles of healthful housing. Committee on the Hygiene of Housing. American Public Health Association, May 1939 (second edition).

[11] The total white population canvassed was 2,249,995. Thus, 18 percent were excluded because not in households containing both the head and his wife. The difference between the figure, 1,841,000, and the population base, 1,769,993, shown in appendix table 1, is due to the further exclusion of persons about whom age, economic status, education of the wife of the head (excluded for reasons of tabulation), or rooms in the dwelling unit was not known.

[12] By age, the percentage distribution of the white population within each degree-of-crowding category was as follows:

Age in years	*Category A*	*Category B*	*Category C*
Under 15	21.6	39.8	46.3
15–24	16.0	20.6	19.3
25–64	57.0	38.0	33.1
65 and over	5.4	1.7	1.2
	100.0	100.0	100.0

The large proportion of children in the more crowded households is of special note.

By size of household, the percentage distribution of the same population was:

Size of household	*Category A*	*Category B*	*Category C*
2–3 persons	43.6	6.9	7.0
4–5 persons	43.5	30.2	24.7
6–7 persons	10.3	46.0	22.1
8 or more persons	2.6	16.9	46.1
	100.0	100.0	100.0

Clearly, the larger households tend to be the more crowded ones.

a necessity to present, in this section and the next, rates for specific age groups which have been adjusted to a standard household-size composition and rates for all ages which have been adjusted to a standard age and household-size composition. Adjustment to a standard age composition requires no explanation. As for household-size adjustment, it was observed from the data that as size of household increased the illness rate decreased. For all incomes, the percentage of persons disabled a week or longer in a 12-month period decreased from 13.6 in households of two or three persons to 11.7 in households of eight persons or more; for the relief group, the percentage fell from 21.6 to 15.2; for the nonrelief group with income under $1,000, from 14.6 to 11.8. Since less complete reporting of illness in the large households appeared to be the chief explanation for this phenomen, it was found desirable to adjust to a standard household-size distribution.[13]

Table 1 demonstrates the effect of such adjustment. The table presents, for the three degree-of-crowding categories, the percentage of persons disabled for a week or longer during the 12 months immediately preceding the enumerator's visit,[14] (1) unadjusted, (2) adjusted to the age distribution of the white population on which the data are based, and (3) adjusted to the age and household-size distribution of the same population. The excess of the percentage in category *C* over that in category *A* is decreased upon adjustment to a standard age distribution but is increased upon adjustment to a standard age and household-size composition.

The percentages are shown also by age in table 1, unadjusted and adjusted to the household-size composition of this population. For each age group, adjustment results in a greater excess of the percentage in category *C* over that in category *A*.

Economic status.—An extremely important fact to be noted from table 1 is that illness rates go up as degree of crowding increases, the ratio of the adjusted rate for category *C* to that for category *A* being 118.[15] Prima facie, there is an association between illness and crowd-

[13] The population used in the adjustment procedure was as follows:

Age in years	Number of persons in household				
	2 or more	2–3	4–5	6–7	8 or more
All ages	1,769,993	609,312	702,782	305,219	152,680
Under 15	472,481	68,198	220,043	116,672	67,568
15–24	301,594	77,751	118,585	66,133	39,125
25–64	917,686	417,021	342,352	114,762	43,551
65 and over	78,232	46,342	21,802	7,652	2,436

[14] Based on persons in the household at the time of the canvass. Persons who were in institutions during the entire 12 months preceding the visit or who died during this period have been excluded from this section on illness and crowding.

[15] For two or more persons per room the percentage of persons disabled was 16.1 (adjusted to the standard age and household-size composition), the ratio of this percentage to that for category *A* being 122.

TABLE 1.—*Effect of adjustment; percentage of persons [1] disabled for a week or longer during 1 year, according to age and persons per room*

Age period in years and nature of percentages	Degree of crowding						
	A. 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room	All households	*A.* 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room
	Percentage disabled				Ratio of rates in *B* and *C* to *A* (*A*=100)		
All ages:							
Percentages unadjusted	13.3	13.7	14.7	13.5	100	103	111
Percentages adjusted for age	13.6	13.2	14.3	13.5	100	97	105
Percentages adjusted for age and size of household	13.2	13.9	15.6	13.5	100	105	118
Under 15:							
Percentages unadjusted	19.6	18.1	17.2	18.9	100	92	88
Percentages adjusted for size of household	19.2	18.7	18.4	19.3	100	97	96
15–24:							
Percentages unadjusted	8.8	8.2	9.2	8.7	100	93	105
Percentages adjusted for size of household	8.7	9.4	11.6	9.0	100	108	133
25–64:							
Percentages unadjusted	11.3	11.5	13.7	11.5	100	102	121
Percentages adjusted for size of household	10.8	11.9	14.3	11.3	100	110	132
65 and over:							
Percentages unadjusted	21.3	21.0	23.7	21.3	100	99	111
Percentages adjusted for size of household	20.1	22.2	25.5	20.5	100	110	127

[1] Data based on 1,769,993 white persons in 83 cities. The population is comprised of persons in households consisting of at least the household head and his wife.
Persons with a confinement or complication of pregnancy or childbirth have been excluded.

ing. Since part of the association can be ascribed to economic factors, table 2 and figure 1 have been prepared to show the situation in households more or less on the same economic level but differing in degree of crowding. In the relief group and the group with annual family income under $1,000, an increase in the degree of crowding was accompanied by an increase in the percentage of persons disabled for a week or longer over a 12-month period. It is of note that, in general, the relative increase in this percentage with greater crowding varied inversely with income. (For the purpose of this discussion, the relief group has been taken to be the lowest income group.) At the $1,000 to $1,500 level the ratio of the rate in category *C* to that in *A* was 98, for households with income below $1,000 it was 104, for the relief group, 113.

That the ratios of the rates in category *C* to those in category *A* were lower for the specific income groups than for the population as a whole is explained by the interaction of two factors: (1) The higher illness rates in the low-income brackets, and (2) the greater concentration of these low-income groups in the categories of increased crowding.

Data for that portion of the population above the $1,500 income level are hereafter omitted because the value of the index, persons per

room, as a measure of poor housing among higher income groups [16] is seriously doubted.

Age.—In table 2 is also shown the percentage of persons disabled annually for a week or longer in each of four broad age groups. For all incomes combined, the percentage of persons thus disabled rose with increase in degree of crowding (in all but the earliest age period). Rates for the oldest group fluctuated with crowding, going up with increase in crowding in some income classes, coming down with such increase in others. These irregular tendencies may have been due in

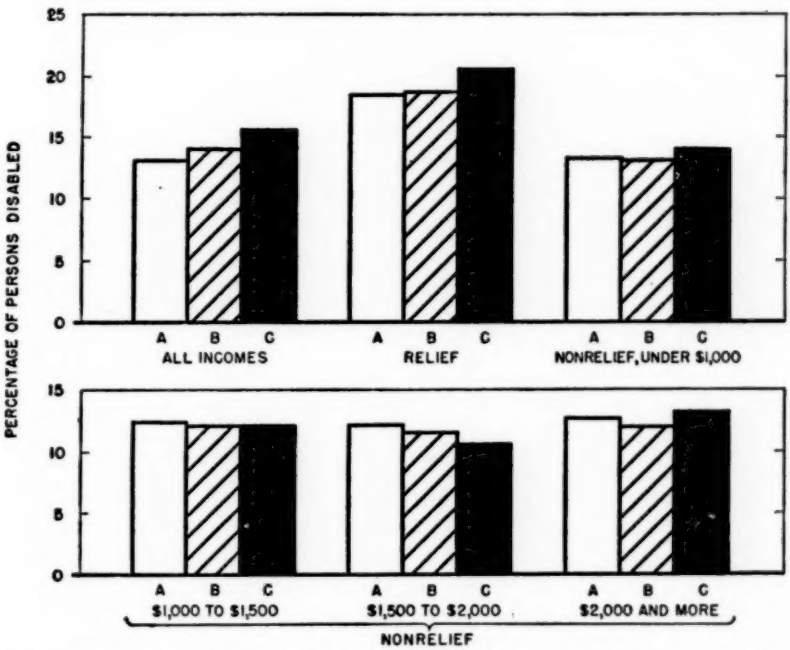

FIGURE 1.—Percentage of persons disabled for a week or longer during 1 year, by degree of crowding and economic status. (Adjusted to a standard age and household-size composition.)

part to the small number of persons constituting this age group in the more crowded categories. (See appendix table 1.) Somewhat more stable were the differences in illness rate with crowding for persons between the ages of 25 and 65. In each of the three lowest income groups the ratio of the rate in category *C* to that in category *A* was

[16] Comparisons of illness rates by economic status may be found in several previous papers presenting National Health Survey data:

Britten, R. H., Collins, S. D., and Fitzgerald, J. S.: The National Health Survey: Some general findings as to disease, accidents, and impairments in urban areas. Pub. Health Rep., 55: 444–470 (1940).

Illness and medical care in relation to economic status. National Health Survey, Preliminary Reports, Sickness and Medical Care Series, Bulletin No. 2, Division of Public Health Methods, National Institute of Health, U. S. Public Health Service, Washington, 1938.

Disability from specific causes in relation to economic status. National Health Survey, Preliminary Reports, Sickness and Medical Care Series, Bulletin No. 9, Division of Public Health Methods, National Institute of Health, U. S. Public Health Service, Washington, 1938.

Perrott, G. St. J., and Holland, Dorothy F.: Health as an element in social security. Annals of the American Academy of Political and Social Science, 202: 116–136 (1939).

TABLE 2.—*Percentage of persons*[1] *disabled for a week or longer during 1 year, according to economic status, age, and persons per room*

Annual family income and relief status, and age in years	Degree of crowding						
	A. 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room	All households	*A.* 1 person or less per room	*B.* More than 1 person per room but not more than 1.5	*C.* More than 1.5 persons per room
	Percentage disabled[2]				Ratio of rates in *B* and *C* to *A* (*A*=100)		
Relief—all ages	18.3	18.4	20.6	18.8	100	101	113
Under 15	21.7	21.9	22.5	22.1	100	101	104
15–24	11.8	12.1	13.9	12.2	100	103	118
25–64	17.4	17.4	20.5	18.0	100	100	118
65 and over	28.5	28.3	30.6	29.2	100	99	107
Nonrelief:							
Under $1,000—all ages	13.4	13.3	14.0	13.5	100	99	104
Under 15	17.8	17.6	15.3	17.9	100	99	86
15–24	8.9	10.0	11.1	9.2	100	112	125
25–64	11.8	11.5	12.4	11.9	100	97	105
65 and over	21.1	22.0	28.0	21.9	100	104	133
$1,000 to $1,500—all ages	12.2	11.9	11.9	12.3	100	98	98
Under 15	18.2	17.3	16.5	18.1	100	95	91
15–24	8.2	7.2	9.7	8.2	100	88	118
25–64	10.0	9.6	10.3	10.1	100	96	103
65 and over	19.5	21.1	14.2	19.5	100	108	73
$1,500 to $2,000—all ages	12.0	11.4	10.6	12.0	100	95	88
Under 15	18.7	16.9	13.6	18.4	100	90	73
15–24	8.3	7.7	9.2	8.3	100	93	111
25–64	9.4	9.2	9.1	9.6	100	98	97
65 and over	17.4	16.7	13.4	17.2	100	96	77
$2,000 and over—all ages	12.7	11.8	12.9	12.7	100	93	102
Under 15	20.8	18.8	20.1	20.7	100	90	97
15–24	8.3	7.4	9.5	8.2	100	89	114
25–64	9.8	8.6	10.1	9.8	100	88	103
65 and over	16.9	20.5	17.2	17.0	100	121	102
All incomes—all ages	13.2	13.9	15.6	13.5	100	105	118
Under 15	19.2	18.7	18.4	19.3	100	97	96
15–24	8.7	9.4	11.6	9.0	100	108	133
25–64	10.8	11.9	14.3	11.3	100	110	132
65 and over	20.1	22.2	25.5	20.5	100	110	127

[1] Data based on 1,769,993 white persons in 83 cities. The population is comprised of persons in households consisting of at least the household head and his wife. Persons with a confinement or complication of pregnancy or childbirth have been excluded.

[2] Rates for age groups adjusted to a standard household-size composition and, for all ages, to a standard age and household-size composition.

over 100 (118 for the relief group). But most closely associated with crowding were the illness rates for the youth group. For those in relief households, the ratio of the rate in category *C* to that in *A* was a little below 120; for those in nonrelief households with income below $1,000, the ratio was somewhat above this figure.[17]

[17] Table 1 shows that before adjustment to a standard household-size composition the differences by degree of crowding in this age group were not nearly so great. Two factors combine to account for this difference between the adjusted and unadjusted figures. First, 76 percent of this age group in category *C* were in households of six or more persons, while in category *A* only 20 percent of this age group were found in such large households. Second, the illness rate for this age group dropped sharply with increase in size of household. For all incomes, the unadjusted rate decreased from 10.4 percent for youths in households of 2 to 3 persons to 7.4 percent for youths in households of 8 or more persons. Since the large households were proportionately so numerous in category *C*, the effect of their rates was to lower the rate for the category as a whole.

At all income levels except the lowest (relief), the percentage disabled in the age group under 15 years decreased as the degree of crowding increased, the net result for all incomes combined being a slightly lower rate for categories *B* and *C* than for *A*. With reference to this point, it will be shown later in this article (1) that when seven communicable diseases common among children were examined—and communicable disease plays an important role in the illnesses of childhood—all but one showed an increase in frequency among children under 5 years of age with greater crowding; (2) that the frequency of pneumonia and tuberculosis disabling for a week or longer showed most striking excesses in the age group under 15 with increased crowding; (3) that disability among children on the day of the interview was more prevalent in the more crowded homes; and (4) that among children, home accidents serious enough to disable for at least a week occurred more often where rental or value of the dwelling was low.

Figure 2 summarizes some of the data on age given in table 2. The rates by age and degree of crowding for the three lowest income groups are shown.

Prevalence.—The proportion of persons disabled on the day of the visit offers another measure for evaluating the relationship between illness and housing. Since the number of illnesses recorded on the day of the visit was heavily weighted by cases chronic in nature, the rate has been broken down into (1) percentage of persons who were disabled on the day of visit and who were not reported as having a chronic disease or impairment [18] (table 3); (2) percentage of persons who were disabled on day of visit and who were reported as having a chronic disease or impairment (table 4). About half of those in this latter group had been disabled for the entire 12 months immediately preceding the visit.

Elimination of chronic cases from the total picture leaves rates which showed on the whole, for each of the income classes and age periods, a marked excess in the rate in category *C* over that in category *A* (table 3). Perhaps the most distinctive feature of the table is the rise in rate among children under 15 years with increased crowding, the relief group, for instance, showing a ratio of the rate in category *C* to that in category *A* of 135. Furthermore, the rate (due mostly to colds) was much higher in this age group as a whole than in any other.

It is to be observed from table 4 that little or no relation existed at specific income levels between crowding and the proportion of persons who were disabled on the day of the visit and who were reported as having a chronic disease or impairment. Only the specific age groups

[18] Diseases the symptoms of which were stated to have been present for 3 months or longer, whether disabling or not, have been classified as chronic.

Impairments included are orthopedic impairments (loss of members or presence of crippled or paralyzed members), blindness (in one or both eyes), and deafness.

within the relief group showed any consistent increase in prevalence rate with increase in crowding.[19]

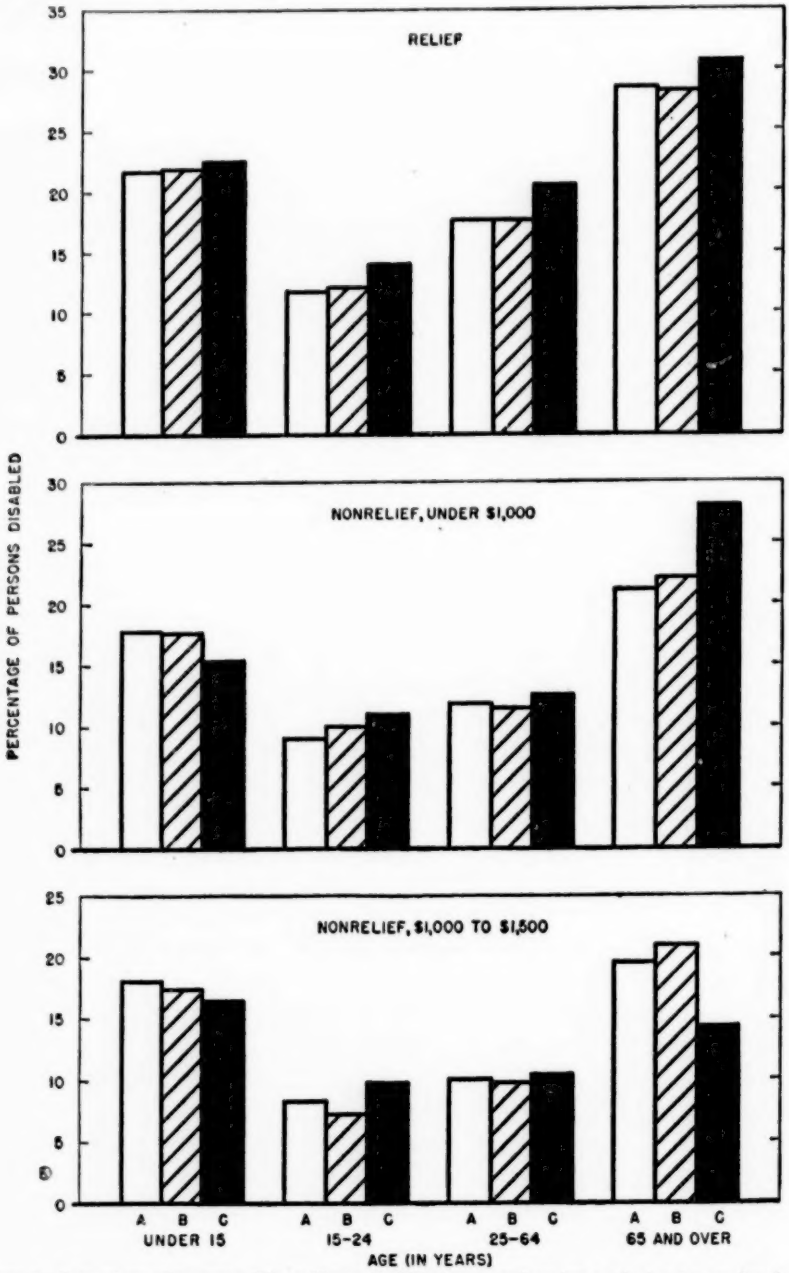

FIGURE 2.—Percentage of persons with an illness disabling for a week or longer during 1 year, by degree of crowding, age, and economic status. (Adjusted to a standard household-size composition.)

[19] That the ratio of the prevalence rate in category *C* to that in *A* was so much higher for all incomes combined than for any of the specific income groups is explainable, as in the case of illness incidence (table 2), by the fact that the higher income groups, with their lower rates, were concentrated in category *A* while category *C* was composed largely of low-income persons with higher rates.

TABLE 3.—*Percentage of persons* [1] *disabled on day of visit and who were not reported as having a chronic disease or impairment, according to economic status, age, and persons per room*

Annual family income and relief status, and age in years	Degree of crowding						
	A. 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room	All households	*A.* 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room
	Percentage disabled [2]				Ratio of rates in *B* and *C* to *A* (*A*=100)		
Relief—all ages	1.99	2.01	2.31	2.07	100	101	116
Under 15	3.38	3.70	4.55	3.62	100	109	135
15–24	1.51	1.09	1.56	1.45	100	72	103
25–64	1.57	1.49	1.72	1.59	100	95	110
65 and over	1.76	1.89	----	1.88	100	107	----
Nonrelief:							
Under $1,000—all ages	1.59	1.63	1.89	1.69	100	103	119
Under 15	2.80	2.93	3.17	2.95	100	105	113
15–24	1.21	1.09	1.22	1.19	100	90	101
25–64	1.18	1.25	1.36	1.29	100	106	115
$1,000 to $1,500—all ages	1.48	1.64	2.15	1.59	100	111	145
Under 15	2.77	3.01	4.67	2.89	100	109	169
15–24	1.09	1.21	1.86	1.15	100	111	171
25–64	1.04	1.05	1.46	1.10	100	101	140
65 and over	1.53	2.64	----	1.57	100	173	----
All incomes [3]—all ages	1.66	1.69	2.06	1.72	100	102	124
Under 15	3.00	3.17	3.89	3.12	100	106	130
15–24	1.19	1.07	1.48	1.20	100	90	124
25–64	1.21	1.21	1.50	1.25	100	100	124
65 and over	1.65	1.78	2.52	1.70	100	108	153

[1] Data based on 1,769,993 white persons in 83 cities. The population is comprised of persons in households consisting of at least the household head and his wife. Persons with a confinement or complication of pregnancy or childbirth have been excluded.

[2] Rates for age groups adjusted to a standard household-size composition and, for all ages, to a standard age and household-size composition. Rates are not shown where there were fewer than 20 cases enumerated. Where rates in both categories *B* and *C* would not be shown under this rule, the entire line has been omitted.

[3] Includes persons with income of $1,500 or more.

The above facts—marked relation between crowding and acute illness, and virtually no relation between crowding and chronic illness (at specific income levels)—may be the closest approach thus far in this paper to an evaluation of the inherent association between bad housing and poor health. As a general rule, loss of wages because of an acute illness present on the day of the visit would not have been a factor causing the family to live in congested quarters. That some of the excess in rate among persons in crowded households was due to bad housing would seem a reasonable conclusion.

III. SELECTED DIAGNOSES AND CROWDING

This section deals with an examination of the data on certain diseases that might be expected to show some relation to housing; namely, pneumonia, influenza, tuberculosis, rheumatism, and seven of the more common communicable diseases of childhood. The tables in this section have been prepared in a manner similar to those in the

TABLE 4.—*Percentage of persons* [1] *disabled on day of visit and who were reported as having a chronic disease or impairment, according to economic status, age, and persons per room*

Annual family income and relief status, and age in years	Degree of crowding						
	A. 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room	All households	*A.* 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room
	Percentage disabled [1]				Ratio of rates in *B* and *C* to *A* (*A*=100)		
Relief—all ages	4.82	4.32	5.08	4.84	100	90	105
Under 15	1.10	1.10	1.28	1.14	100	100	116
15–24	1.87	2.04	2.09	1.95	100	109	112
25–64	6.23	5.39	6.38	6.19	100	87	102
65 and over	18.06	19.69	18.97	18.92	100	109	105
Nonrelief:							
Under $1,000—all ages	2.72	2.53	2.65	2.69	100	93	97
Under 15	.77	.69	.67	.77	100	90	87
15–24	1.06	1.20	1.13	1.09	100	113	107
25–64	3.40	2.85	2.92	3.30	100	84	86
65 and over	12.03	13.73	17.02	12.55	100	114	141
$1,000 to $1,500—all ages	1.84	1.66	1.46	1.84	100	90	79
Under 15	.72	.61	.33	.72	100	85	46
15–24	.83	.64	.67	.84	100	77	81
25–64	2.10	1.71	1.72	2.08	100	81	82
65 and over	10.73	12.32	7.97	10.61	100	115	74
All incomes [3]—all ages	2.17	2.56	3.07	2.27	100	118	141
Under 15	.78	.80	.91	.81	100	103	117
15–24	.93	1.16	1.32	1.00	100	125	142
25–64	2.52	2.88	3.66	2.70	100	114	145
65 and over	10.86	14.27	15.47	11.28	100	131	142

[1] Data based on 1,769,993 white persons in 83 cities. The population is comprised of persons in households consisting of at least the household head and his wife.
[2] Rates for age groups adjusted to a standard household-size composition, and, for all ages, to a standard age and household-size composition.
[3] Includes persons with income of $1,500 or more.

preceding section; that is, to show illness rates [20] at different levels of crowding, classified by economic status and age; and to show also (except for table 10) the ratios of the rates in categories *B* and *C* to those in *A*, with the rates in category *A* expressed as 100.

Pneumonia.[21]—As may be observed from table 5, there was a marked increase in the frequency of pneumonia with increase in degree of crowding, particularly within the relief group and the marginal self-supporting group (nonrelief, under $1,000). For the former, the pneumonia rate was about 60 percent higher in category *C* than in category *A;* for the latter, it was 45 percent higher. This rise in the rate, especially among children, of an acute disease which so often terminates fatally, may be at least partially accounted for by bad housing. The spread of the disease through contact infection (and

[20] The illness rate used in the remainder of this paper is the frequency of illness per 1,000 persons. Institutionalized cases and cases ending in death are included.

[21] All forms; sole or primary diagnoses only. (The primary diagnosis is that which had been associated with the disability for the longest period; or, if a separate period of disability was not specified for any diagnosis, the primary diagnosis is the one which was regarded by the family as the most important cause of the disability.)

overcrowding), the viability of the pneumococcus in dried sputum and in dust, the debilitation and breakdown of human resistance brought about by exposure to cold in ill-heated, ill-ventilated habitations are all regarded as conducive factors.

TABLE 5.—*Frequency of pneumonia* [1] *disabling for a week or longer during 1 year, according to economic status, age, and persons per room* [2]

Annual family income and relief status, and age in years	Degree of crowding						
	A. 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room	All households	*A.* 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room
	Frequency per 1,000 persons [3]				Ratio of rates in *B* and *C* to *A* (*A*=100)		
Relief—all ages	6.06	8.32	9.73	6.89	100	137	161
Under 15	11.20	13.56	19.79	12.72	100	121	177
15–24	3.21	4.28	3.35	3.48	100	133	104
25–64	4.48	6.71	7.89	5.35	100	150	176
Nonrelief:							
Under $1,000—all ages	4.07	5.47	5.92	4.47	100	134	145
Under 15	8.03	10.39	11.83	8.82	100	129	147
15–24	1.96	2.93	----	2.19	100	149	----
25–64	2.80	3.88	4.13	3.07	100	139	148
$1,000 to $1,500—all ages	3.76	4.26	4.35	3.98	100	113	116
Under 15	7.06	7.60	7.32	7.40	100	108	104
15–24	1.82	1.85	1.57	1.90	100	102	86
25–64	2.59	2.93	3.75	2.75	100	113	145
All incomes [4]—all ages	4.01	5.39	6.72	4.47	100	134	168
Under 15	7.54	10.18	14.16	8.42	100	135	188
15–24	2.07	2.90	3.02	2.25	100	140	146
25–64	2.82	3.99	5.20	3.15	100	141	184
65 and over	7.64	8.92	----	7.67	100	117	----

[1] Sole or primary diagnoses.
[2] Data based on 1,769,993 white persons in 83 cities. The population is comprised of persons in households consisting of at least the household head and his wife.
[3] Rates for age groups adjusted to a standard household-size composition and, for all ages, to a standard age and household-size composition. Rates are not shown where there were fewer than 20 cases enumerated. Where rates in both categories *B* and *C* would not be shown under this rule, the entire line has been omitted.
[4] Includes persons with income of $1,500 or more.

Influenza.[22]—The association between overcrowding and the frequency of influenza may be seen in table 6. The relief group showed an increase of 19 percent in frequency as the degree of crowding increased from one person or less per room to more than one and a half persons per room (from category *A* to category *C*); the group reporting incomes of less than $1,000 showed a slightly greater increase (22 percent).

There was a marked association between degree of crowding and the frequency of influenza among persons between the ages of 25 and 65. For the portion of this age group on relief, the frequency was almost a third greater in category *C* than in *A;* in the next higher

[22] Influenza and grippe; sole or primary diagnoses only. Included are disabling ailments reported as intestinal influenza or grippe, influenza or grippe accompanied by sore throat, laryngitis, bronchitis, or sonsillitis.

income group, the frequency was a fourth greater. Since influenza usually runs a brief, acute course, loss of earnings because of this disease would not in general operate as a selective factor to force households to move into more crowded dwellings.

TABLE 6.—*Frequency of influenza [1] disabling for a week or longer during 1 year, according to economic status, age, and persons per room [2]*

Annual family income and relief status, and age in years	Degree of crowding						
	A. 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room	All households	*A.* 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room
	Frequency per 1,000 persons [3]				Ratio of rates in *B* and *C* to *A* (*A*=100)		
Relief—all ages	19.4	20.1	23.1	20.5	100	104	119
Under 15	16.9	18.1	14.9	17.8	100	107	88
15–24	17.5	16.0	18.4	17.6	100	91	105
25–64	20.4	21.6	26.4	22.0	100	106	129
65 and over	27.1	22.8	----	26.2	100	84	----
Nonrelief:							
Under $1,000—all ages	15.6	16.4	19.1	16.5	100	105	122
Under 15	14.6	16.9	14.8	15.7	100	116	101
15–24	14.2	13.7	17.0	14.6	100	96	120
25–64	16.0	16.9	20.0	17.0	100	106	125
65 and over	22.0	21.5	----	22.0	100	98	----
$1,000 to $1,500—all ages	15.5	14.8	13.6	15.2	100	95	88
Under 15	15.7	14.9	9.9	15.2	100	95	63
15–24	13.0	12.0	13.4	12.7	100	92	103
25–64	15.9	15.4	15.0	15.8	100	97	94
65 and over	21.8	22.6	----	20.1	100	104	----
All incomes [4]—all ages	17.4	16.5	18.8	17.5	100	95	108
Under 15	18.9	16.5	14.6	18.4	100	87	77
15–24	14.6	13.1	15.9	14.5	100	90	109
25–64	17.3	17.3	20.6	17.7	100	100	119
65 and over	20.6	18.9	28.9	20.4	100	92	140

[1] Sole or primary diagnoses.
[2] Data based on 1,769,993 white persons in 83 cities. The population is comprised of persons in households consisting of at least the household head and his wife.
[3] Rates for age groups adjusted to a standard household-size composition and, for all ages, to a standard age and household-size composition. Rates are not shown where there were fewer than 20 cases enumerated.
[4] Includes persons with income of $1,500 or more.

Tuberculosis.[23]—"Certainly crowding must facilitate the spread of infection in families where open cases exist, but it is usually so inextricably tied up with low wages, and the resulting inadequate nutrition, fatigue, and other conditions favorable to the spread of disease that the effects of overcrowding in itself are hard to measure." [24] Because of these conditions, and because of the chronic nature of the disease and the frequent removal to institutions of active cases,[25] no

[23] All forms; sole or primary diagnoses only.
[24] Rosenau, Milton J.: Preventive Medicine and Hygiene. 6th edition. D. Appleton-Century Co., 1935, p. 52.
[25] Persons in institutions for the care of physical or mental diseases were not directly enumerated in the National Health Survey, but the family was asked to report with regard to any such persons who had formerly lived in the household. The record obtained was incomplete; hence, the cases of tuberculosis on which the rates in table 7 are based are largely those still in the home.

very clear picture of the association between congestion in the home and the prevalence of this disease is possible from the data of the National Health Survey.

Table 7, however, does show that there was a considerable increase in the frequency of tuberculosis with increase in crowding, both for the relief group and for all incomes combined. Greatest association with crowding was found for the illness rates in the youngest age group, with a ratio of the rate in category *C* in the relief group to that in *A* of 260, a ratio much higher than that shown by the 25–64-year age group (158) or the group between 15 and 25 years of age (131).[26]

TABLE 7.—*Frequency of tuberculosis*[1] *disabling for a week or longer during 1 year, among persons under 65 years, according to economic status, age, and persons per room*[2]

Annual family income and relief status, and age in years	Degree of crowding						
	A. 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room	All households	*A.* 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room
	Frequency per 1,000 persons[3]				Ratio of rates in *B* and *C* to *A* (*A*=100)		
Relief—all ages under 65	2.83	2.64	4.[illegible]	2.92	100	93	159
Under 15	.94	.73	2.44	.97	100	78	260
15–24	2.55	2.32	3.34	2.55	100	91	131
25–64	3.74	3.58	5.90	3.94	100	96	158
Nonrelief:							
Under $1,000:							
All ages under 65	1.22	1.29	.91	1.27	100	106	75
25–64	1.45	1.91	----------	1.60	100	132	----------
$1,000 to $1,500:							
All ages under 65	.88	.70	1.08	.85	100	80	123
25–64	1.14	.91	----------	1.09	100	80	----------
All incomes[4]—all ages under 65	1.02	1.24	1.95	1.10	100	122	191
Under 15	.40	.33	1.08	.42	100	83	270
15–24	1.34	1.10	1.44	1.34	100	82	107
25–64	1.24	1.69	2.68	1.41	100	136	216

[1] Sole or primary diagnoses.
[2] Data based on 1,691,761 persons under 65 years of age in 83 cities. The population is comprised of persons in households consisting of at least the household head and his wife.
[3] Rates for age groups adjusted to a standard household-size composition and, for 3 age groups combined, to a standard age and household-size composition. Rates are not shown where there were fewer than 20 cases enumerated. Where rates in both categories *B* and *C* would not be shown under this rule, the entire line has been omitted.
[4] Includes persons with income of $1,500 or more.

Rheumatism.[27]—Though chronic in nature, rheumatism suggests some connection with bad housing, since dampness and cold are considered to be important predisposing factors. Whatever the pre-

[26] Rates classified by age have been largely omitted from table 7 for the reason that above the relief level there were not more than 11 cases tabulated in category *C* for any age period. The oldest age group, 65 years and over, has been omitted entirely since there were only 4 cases enumerated in category *B* and 4 cases in category *C*.

[27] Sole or primary diagnoses only. Under the head of rheumatism are included also arthritis, gout, neuralgia, neuritis, lumbago, stiff neck, and other muscular pains.

cise causal relations, that greater frequency of rheumatism and greater crowding were found together is of significance in the hygiene of housing (table 8). Table 8 also gives the frequency of rheumatism and allied diseases (among persons 25 years of age or over) according to three age periods.[28] All three periods demonstrated much the same association between rheumatism and crowding, category *C* showing a consistent excess over category *A* in frequency of disabling rheumatism (except in the $1,000 to $1,500 income group).

TABLE 8.—*Frequency of rheumatism* [1] *disabling for a week or longer during 1 year, among persons aged 25 or more, according to economic status, age, and persons per room* [2]

Annual family income and relief status, and age in years	Degree of crowding						
	A. 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room	All households	*A.* 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room
	Frequency per 1,000 person [3]				Ratio of rates in *B* and *C* to *A* (*A*=100)		
Relief—25 and over	14.6	14.2	16.9	15.2	100	97	116
25–44	9.4	9.4	9.9	9.8	100	100	105
45–64	19.8	18.4	22.8	20.7	100	93	115
65 and over	30.0	31.8	----------	31.6	100	105	----------
Nonrelief:							
Under $1,000—25 and over	9.0	8.2	10.5	9.0	100	91	117
25–44	5.4	5.3	7.3	5.4	100	98	135
45–64	12.1	10.7	12.7	12.4	100	88	105
$1,000 to $1,500—25 and over	7.0	7.0	4.7	6.8	100	100	67
25–44	3.9	3.1	2.9	3.6	100	79	74
45–64	9.6	9.8	8.3	9.5	100	102	86
All incomes [4]—25 and over	7.5	9.0	10.7	7.9	100	120	143
25–44	4.3	5.5	6.5	4.6	100	128	151
45–64	10.2	12.1	14.4	10.7	100	119	141
65 and over	19.7	22.5	24.1	20.0	100	114	122

[1] Includes arthritis, gout, neuralgia, neuritis, lumbago, stiff neck, and other muscular pains; sole or primary diagnoses.

[2] Data based on 995,921 white persons aged 25 or over in 83 cities. The population is comprised of persons in households consisting of at least the household head and his wife.

[3] Rates for age groups adjusted to a standard household-size composition and, for 3 age groups combined, to a standard age and household-size composition. Rates are not shown where there were fewer than 20 cases enumerated. Where rates in both categories *B* and *C* would not be shown under this rule, th entire line has been omitted.

[4] Includes persons with income of $1,500 or more.

Figure 3 summarizes some of the data on the four diagnoses—pneumonia, influenza, tuberculosis, and rheumatism. The figure shows graphically the frequency with which these diseases disabled, for a week or longer, persons in different economic groups and living under different degrees of crowding. It may be observed for each diagnosis that in general the incidence was higher with increased crowding. This rise in illness rate was greatest in the instances of

[28] Rates for childhood and youth would have introduced what was really a separate diagnosis—acute rheumatic fever. Rates have also been omitted for the old-age group above the relief level, since there were fewer than 20 cases enumerated in categories *B* and *C*.

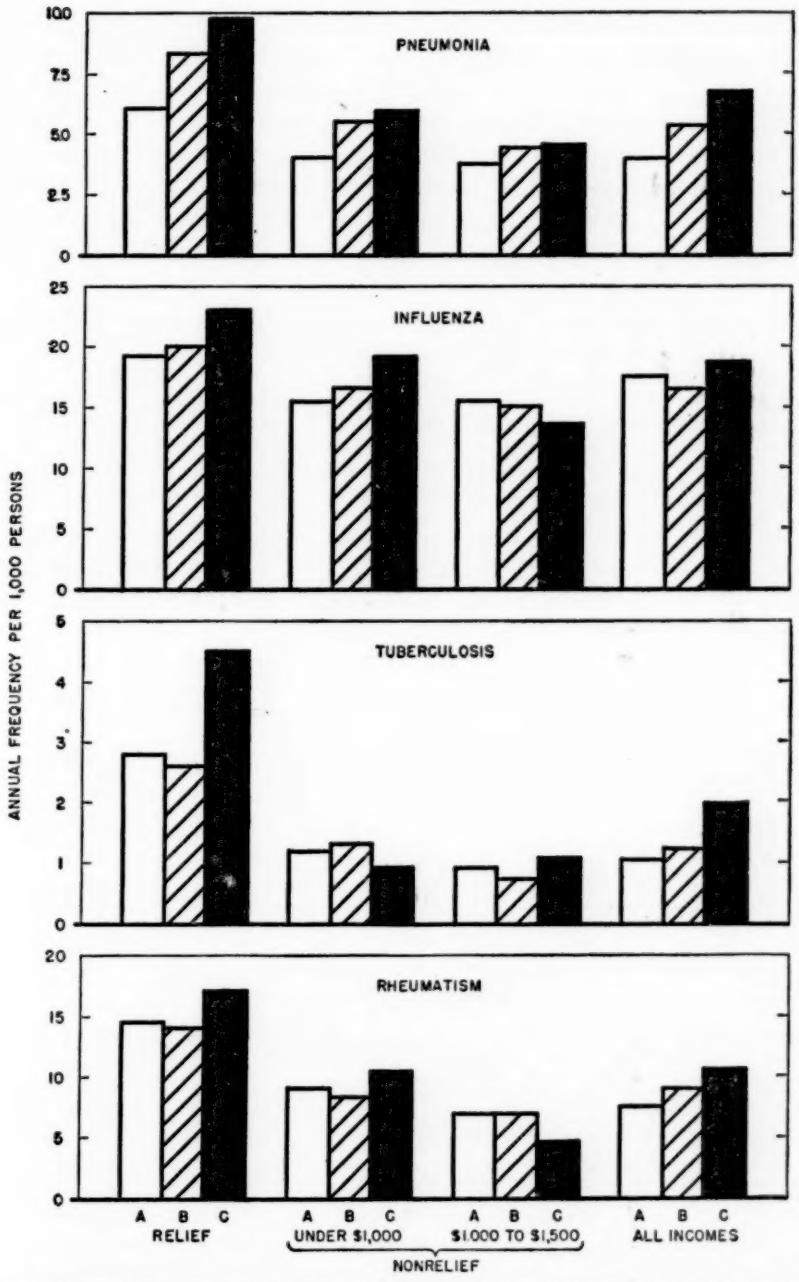

FIGURE 3.—Annual frequency among persons of 4 diagnoses (illnesses disabling for a week or longer), by degree of crowding and economic status. (Adjusted to a standard age and household-size composition.)

pneumonia and tuberculosis; for influenza and rheumatism the rise in rate was marked by its consistency, except for the group with income between $1,000 and $1,500.

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Common communicable diseases of childhood.—The diseases included under this head are measles, whooping cough, chickenpox, mumps, scarlet fever, German measles, and diphtheria,[29] all contracted through contact with cases or carriers. Table 9 gives for each of these diseases the incidence rates of cases disabling for a week or longer among children under 5 years and among those between 5 and 10 years of age. Since the incidence of these diseases varied but little with income, comparisons have not been made by economic status.[30] Also, no adjustment to a standard household-size distribution has been made because, on the whole, the illness rates for children under 5 years of age tended to increase with size of household.[31]

TABLE 9.—*Frequency among children [1] of certain communicable diseases [2] of childhood disabling for a week or longer during 1 year, by age and persons per room*

Diagnosis and age in years	Degree of crowding						
	A. 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room	All households	*A.* 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room
	Frequency per 1,000 persons				Ratio of rates in *B* and *C* to *A* (*A*=100)		
Diphtheria:							
Under 5	0.80	1.42	2.18	1.15	100	178	272
5–9	1.18	1.49	2.21	1.41	100	126	187
Mumps:							
Under 5	8.2	11.5	14.2	9.9	100	140	173
5–9	29.3	27.4	30.4	29.0	100	94	104
Scarlet fever:							
Under 5	5.62	8.65	7.30	6.60	100	154	130
5–9	17.08	16.08	12.28	16.11	100	94	72
German measles:							
Under 5	3.07	3.89	3.98	3.40	100	127	130
5–9	7.58	7.76	5.83	7.36	100	102	77
Chickenpox:							
Under 5	20.4	23.3	23.0	21.4	100	114	113
5–9	37.3	28.0	20.3	32.4	100	75	54
Measles:							
Under 5	36.0	39.7	38.1	37.2	100	110	106
5–9	63.4	52.1	42.6	57.4	100	82	67
Whooping cough:							
Under 5	25.7	23.4	21.3	24.5	100	91	83
5–9	20.1	15.6	12.5	17.8	100	78	62

[1] Data based on 142,957 white children under 5 years and 160,785 white children between the ages of 5 and 10 in 83 cities. The population is comprised of children in households consisting of at least the household head and his wife.

[2] Sole or primary diagnoses.

[29] Sole or primary diagnoses only.

[30] By income, the rate per 1,000 children varied for the seven diagnoses combined as follows:

Age in years	Relief	Nonrelief			
		Under $1,000	$1,000 to $1,500	$1,500 to $2,000	$2,000 and over
Under 5	124	93	100	101	100
5–9	157	149	157	168	180

[31] For the 7 diagnoses combined, the annual frequency rate per 1,000 children varied by size of household as follows: 2–3 persons, 59; 4–5 persons, 116; 6–7 persons, 129; 8 or more persons, 106.

Among children under 5 years (preschool), each of the diseases, with the exception of whooping cough, showed an excess frequency in category *C* as compared with category *A*, although the frequency of scarlet fever, chickenpox, and measles was higher in category *B* than in *C*.

Among children between the ages of 5 and 10, the frequency of these communicable diseases decreased as the degree of crowding increased, with the exception of diphtheria and mumps. For chickenpox, the rate in category *C* was half that in category *A;* for whooping cough, about 60 percent. But this decrease in rate is no paradox. A single attack of one of these diseases will generally give a lasting immunity against it; so that the population at risk becomes increasingly smaller as children grow older, especially in the case of the more prevalent diseases. A higher incidence rate for the early years of life in any particular group is likely to mean a lowered rate later on. The increase in the rate in the age group under 5 and the decrease in the rate in the age group 5–9 with increased crowding suggests that where crowding exists these communicable diseases of childhood *attack at an earlier age.* It is generally recognized that a younger age incidence is accompanied by greater risk of serious complications and of mortality.

Evidence of this younger age incidence where home congestion obtains is presented in table 10, which gives for each of the children's diseases the ratio of the illness rates for children under 5 years to the corresponding rates for children between 5 and 10 years, according to the degree of crowding. For each of the diagnoses, without exception, the ratios increased from category *A* to category *C*. Chickenpox showed the greatest increase, the ratio more than doubling (from 55 to 113); scarlet fever, too, showed a striking increase, the ratio almost doubling (from 33 to 59). In the case of whooping cough, where the frequency of illness for both age groups had declined with increase in degree of crowding (table 9), the ratio increased by a third (from 128 to 170). These data are graphically portrayed in figure 4. The scales have been arranged so as to make the bars for category *A* of uniform length, thereby simplifying comparisons among the several diagnoses.

IV. DIGESTIVE DISEASES AND TOILET FACILITIES [32]

In this section, persons living in households with private inside flush toilets [33] and persons in households not meeting this standard have been compared as to the annual frequency of certain digestive

[32] A detailed description of the characteristics of the Health Survey population with respect to possession of sanitary facilities is to be published.

[33] The toilet facilities of the households enumerated in the National Health Survey were reported as "private" or "communal" and as "flush, inside," "flush, outside," or "privy." The definitions of the classifications in the text may be summarized as follows: Private—toilets customarily used by the members of one household only, i. e., not shared with any other household; inside—toilets located indoors, i. e., within a building; flush—toilets or water closets with flush bowls, i. e., connected with any water supply.

diseases (disabling for a week or longer)—indigestion and other stomach ailments; diarrhea, enteritis, and colitis; typhoid and paratyphoid

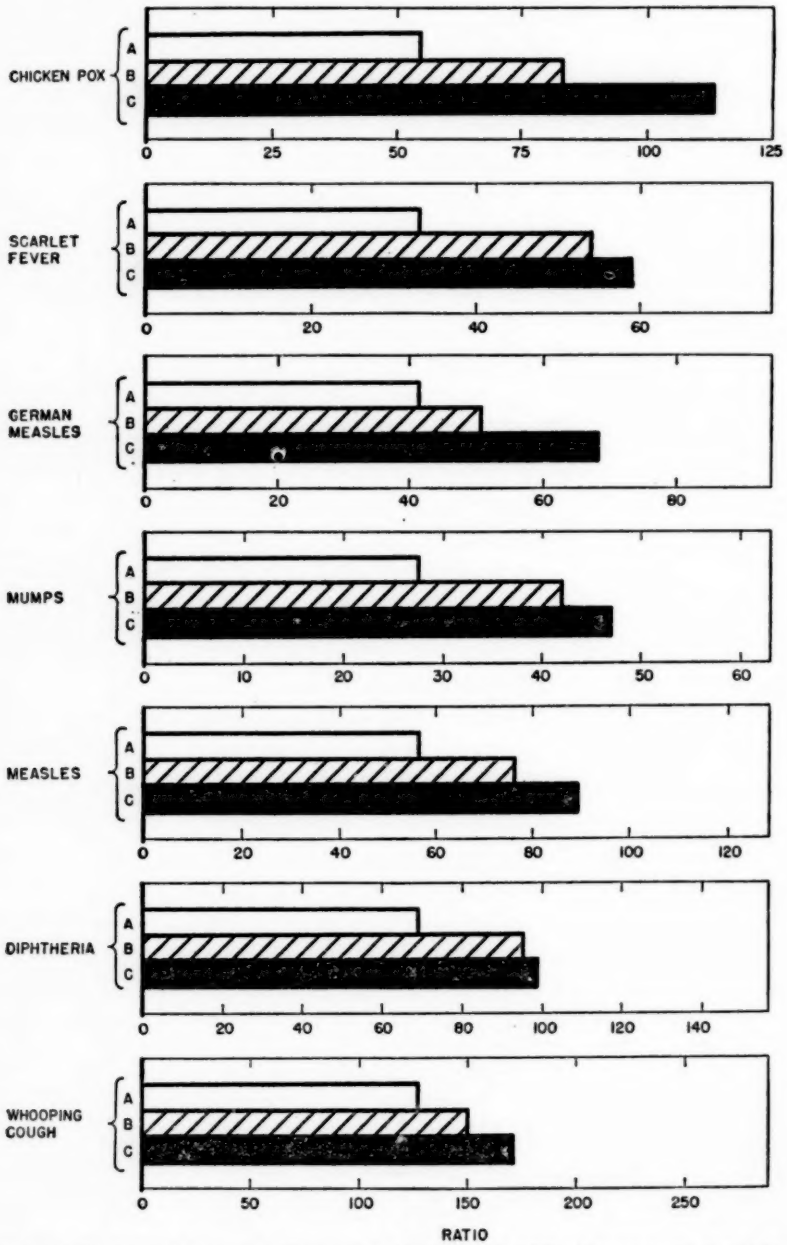

FIGURE 4.—Ratio of annual frequency of 7 communicable diseases of childhood in age group under 5 to that in age group 5–9, by diagnosis and degree of crowding.

fever.[34] As was pointed out in the introductory paper referred to previously (see footnote 3), in households not meeting this standard

[34] Sole, primary, and contributory diagnoses.

there probably were concomitant deficiencies (especially, lack of screening and poor facilities for refrigeration of food) which may have an effect on the illness rate from this group of digestive diseases. Moreover, as in the case of crowding, the index used tends to measure poor housing as a whole.[35]

TABLE 10.—*Ratio of frequency of common communicable diseases of childhood* [1] *disabling for a week or longer during 1 year in age group under 5 to that in age group 5–9* [2] *for each degree-of-crowding group*

(Frequency in age group 5-9=100)

Diagnosis	Degree of crowding		
	A. 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room
Diphtheria	68	95	99
Mumps	28	42	47
Scarlet fever	33	54	59
German measles	41	50	68
Chickenpox	55	83	113
Measles	57	76	89
Whooping cough	128	150	170

[1] Sole or primary diagnoses.
[2] Data based on 142,957 white children under 5 years and 160,785 white children between the ages of 5 and 10 in 83 cities. The population is comprised of children in households consisting of at least the household head and his wife.

In table 11 is shown the frequency, over a 12-month period, of disability (for a week or longer) from these diseases among those who did and those who did not live in households with private inside flush toilets.[36] The rate for the latter group was almost 70 percent in excess of the rate for the former. Typhoid fever, as might be expected,

[35] The following table, based on a 0.5-percent random sample of punched cards, indicates how closely related are overcrowding and the absence of a private inside flush toilet:

Size of city	Percentage of households without a private inside flush toilet, by degree of crowding		
	A. 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room
100,000 and over	4.2	10.0	22.7
25,000 to 100,000	6.7	13.5	45.0
Under 25,000	12.2	31.6	60.0

In each of the three city-size groups, the percentage of households without a private inside flush toilet rose markedly as degree of crowding increased (the data being shown by city-size group because of differences in frequency of substandard facilities with size of city).

[36] The population base in this section differs somewhat from that in the foregoing sections because of differences in the character of the exclusions made. Excluded here were all persons in single-person households and persons for whom the annual family income or the type of toilet facility used at home was unknown. The population remaining numbered 2,076,641, of whom 172,743 (8.3 percent) did not have private inside flush toilets. (Thus, the exclusions totaled 173,354 persons or 7.7 percent of the entire white population surveyed.)

The rates in this section are not adjusted to a standard age or household-size composition.

showed the greatest excess, about 100 percent. The frequency of indigestion and other stomach ailments was three-fourths higher, and of diarrhea, enteritis, and colitis, two-fifths higher in the group without private inside flush toilets. That the differences between the rates for the two groups were to a certain extent due to differences in economic status is evidenced by the smaller variations within the specific income groups themselves. However, marked divergences still remain at the two lowest income levels. For the three groups of digestive diseases combined, the frequency of disabling illness in the relief group was 37 percent greater among those who did not have private inside flush toilets than among those who did. For the marginal self-supporting group (nonrelief, under $1,000), the excess was almost as great, 35 percent. Although for the group reporting an income between $1,000 and $1,500 the excess dropped to but 4 percent, it may be pointed out that for the group with income of $1,500 or more the excess amounted to 35 percent.

TABLE 11.—*Frequency of certain digestive diseases* [1] *disabling for a week or longer during 1 year in relation to (a) presence, or (b) absence of a private inside flush toilet, according to economic status* [2]

Annual family income and relief status	Total			Indigestion and other stomach ailments			Diarrhea, enteritis, colitis			Typhoid and paratyphoid fever		
	(a) With	(b) Without	Ratio (b) to (a)	(a) With	(b) Without	Ratio (b) to (a)	(a) With	(b) Without	Ratio (b) to (a)	(a) With	(b) Without	Ratio (b) to (a)
	Disabling illnesses per 1,000 persons and ratio of frequency for those without to those with private inside flush toilets ("with"=100) [3]											
Relief	5.64	7.72	137	4.16	5.68	137	1.27	1.66	131	0.212	0.376	177
Nonrelief:												
Under $1,000	4.39	5.94	135	3.18	4.34	136	1.06	1.34	126	.146	.264	181
$1,000 to $1,500	3.09	3.20	104	2.15	2.38	111						
All incomes [4]	3.61	6.08	168	2.52	4.47	177	.96	1.32	138	.127	.289	228

[1] Sole, primary, and contributory diagnoses.
[2] Data based on 2,076,641 white persons in 83 cities. The population is comprised of persons in households of 2 or more related persons. Of the total, 1,903,898 reported a private inside flush toilet, 172,743 some other type.
[3] Rates are omitted where there were fewer than 20 cases enumerated (in the group without a private inside flush toilet).
[4] Includes persons with income of $1,500 or more.

The question arises as to what relation would be shown if comparisons for some other diseases of the digestive system, not thought of as connected with sanitation, were to be made in the same way. This has been done with a miscellaneous group of digestive diseases including constipation, appendicitis, peritonitis, abdominal adhesions, intestinal obstructions, and others. The results (frequency per 1,000 white persons of illness disabling for a week or longer) were as follows:[37]

[37] About 80 percent of the size of these rates was due to appendicitis.

Annual family income and relief status	Private inside flush toilet		Ratio (b) to (a)
	(a) With	(b) Without	
Relief	7.34	7.15	97
Nonrelief:			
Under $1,000	6.26	5.76	92
$1,000 to $1,500	6.37	5.47	86
All incomes	6.81	6.35	93

Persons living in households without a private inside flush toilet did not show a higher frequency of illness from such causes.

There was marked variation among regions and among cities of different sizes in the proportion of persons having the use of private inside flush toilets (see footnote 32). Hence, examination of the group of digestive diseases shown in table 11 is also made by geographic area and size of city (table 12). It may be readily seen from the table, in which, for brevity, only ratios are shown, (1) that in all except one of the area and city-size groups there was an excess in the rate for the group not having such toilet facilities, and (2) that a similar tendency was shown by the two specific income groups used.

V. HOME ACCIDENTS AND RENTAL (OR VALUE) [38]

No direct information as to the physical condition of the canvassed dwellings was recorded on the survey schedule, and some other index had to be adopted which would permit a study of the relation between hazards in the home and the frequency of serious accidents occurring therein. The most logical index was the rent charged for the dwelling (or its value if occupied by its owner); [39] for, on the average, the lower the rental or value of a house or an apartment, the more dilapidated it is likely to be, the darker the rooms, the greater the fire hazard. That these conditions are conducive to a higher accident rate goes almost without saying.

Since the lower the rental, the more crowded the dwelling unit (see footnote 6), it is clear that the index tends to measure, as do the crowding and toilet facility indexes, the whole poor housing environment. From one point of view, however, we are on surer ground than in the illness rate comparisons, since as a general rule current accidents

[38] A detailed description of the characteristics of the Health Survey population with respect to home accidents will be found in: Britten, R. H., Klebba, J., and Hailman, D. E.: Accidents in the urban home as observed in the National Health Survey. Pub. Health Rep., 55: 2061 (1940).

See also: Accidents as a cause of disability. National Health Survey, Preliminary Reports, Sickness and Medical Care Series, Bulletin No. 3, Division of Public Health Methods, National Institute of Health, U. S. Public Health Service, Washington, 1938.

[39] For households renting their living quarters at the time of the visit a record was made of the monthly rental being charged (not necessarily paid) for such quarters at that time; for households owning their living quarters at such time, the record made was that of the family informant's estimate of the value of such quarters.

TABLE 12.—*Digestive diseases disabling for a week or longer during 1 year: relation of frequency among persons with to frequency among persons without a private inside flush toilet, according to geographic area and size of city and economic status*

Geographic area [1] and size of city (by population)	All incomes	Relief	Nonrelief, under $1,000
	Ratio of frequency among those without to frequency among those with private inside flush toilets ("with"=100)		
All areas—all cities	168	137	135
100,000 and over	143	116	120
25,000–100,000	178	144	131
Under 25,000	164	136	130
Northeast—all cities	136	96	129
100,000 and over	134	105	125
25,000–100,000	211	----	----
Under 25,000	97	59	----
North Central—all cities	200	170	152
100,000 and over	160	129	125
25,000–100,000	178	144	137
Under 25,000	222	252	138
South—all cities	158	127	122
100,000 and over	128	99	133
25,000–100,000	162	125	109
Under 25,000	155	114	105
West—all cities	170	144	116
100,000 and over	169	142	----
25,000–100,000	----	----	----
Under 25,000	163	146	----

[1] The Health Survey States included in the 4 regions are: Northeast—Massachusetts, New Jersey, New York, Pennsylvania; North Central—Illinois, Michigan, Minnesota, Missouri, Ohio; South—Alabama, Georgia, Louisiana, Texas, Virginia; West—California, Oregon, Utah, Washington.

NOTE.—See footnotes to table 11. Ratios are omitted where (for the group without private inside flush toilets) less than 20 cases were enumerated.

TABLE 13.—*Frequency of home accidents [1] disabling for a week or longer during 1 year, by ownership and type of dwelling, monthly rental or value, and age of occupants [2]*

Ownership and type of dwelling; monthly rental or value	Age in years									
	All ages	Under 15	15–24	25–64	65 and over	All ages	Under 15	15–24	25–64	65 and over
	Disabling home accidents per 1,000 persons					Ratio to rate for persons in dwellings of not less than $30 rental or $3,000 value (expressed as 100)				
Rented multiple dwelling:										
Under $10	5.80	4.47	3.15	5.97	26.54	169	152	182	170	240
$10 to $20	4.85	4.78	2.70	4.79	18.30	141	162	156	136	165
$20 to $30	3.66	3.80	1.69	3.66	17.22	106	129	98	104	156
$30 and over	3.44	2.95	1.73	3.52	11.06	100	100	100	100	100
All rentals	4.17	4.02	2.18	4.14	16.10	----	----	----	----	----
Rented single dwelling:										
Under $10	5.44	4.91	3.53	5.88	13.18	134	119	162	143	119
$10 to $20	5.08	5.13	3.21	5.08	11.85	125	125	147	124	107
$20 to $30	4.35	4.74	2.31	4.03	19.44	107	115	106	98	175
$30 and over	4.07	4.12	2.18	4.11	11.09	100	100	100	100	100
All rentals	4.72	4.84	2.81	4.64	13.29	----	----	----	----	----
Owned dwelling:										
Under $1,000	6.76	5.60	3.75	6.01	20.00	142	147	189	140	130
$1,000 to $2,000	5.78	5.47	3.26	5.17	15.88	122	143	165	120	103
$2,000 to $3,000	5.19	4.76	2.80	4.64	13.33	109	125	141	108	87
$3,000 and over	4.75	3.82	1.98	4.30	15.36	100	100	100	100	100
All values	5.01	4.31	2.31	4.49	15.26	----	----	----	----	----
All dwellings	4.64	4.43	2.42	4.41	14.99	----	----	----	----	----

[1] Sole, primary, and contributory diagnoses.
[2] With minor exclusions, data based on the entire surveyed population, white and colored (2,415,000 persons).

will not of themselves have driven the family into homes for which lower rents are charged.

For purposes of comparison the dwellings surveyed have been divided into "owned" (i. e., owner-occupied) and "rented," and the latter group further subdivided by type of dwelling into "single" and "multiple." [40] As shown in the first column of table 13, each group evidenced a marked rise in rate of accidents disabling for a week or longer with decrease in rental or value of the dwelling.[41] Most outstanding is the 70 percent increase in accident rate with decline in monthly rental from $30 or more to less than $10 for persons living in rented multiple dwellings.

Age of occupants.—Closest association between accidents and dwelling rental or value was in general shown by the youth group (15–24 years). For those of this group in owned homes and in rented multiple dwellings the rate almost doubled as the value reported dropped from $3,000 or more to less than $1,000 and as monthly rental dropped from $30 or more to less than $10; for those in rented single dwellings the excess was over 60 percent. For the other age groups, the excess in accident rate at one rental or value over the next higher rental or value varied from one type of dwelling to another; but chief significance must be attached to the very persistency of these variations in the one direction. As rental or value went down, the accident rate went up. This is portrayed graphically in figure 5, where the rented multiple dwelling was selected as illustrative of the point.[42]

Sex.—Variations by sex are of particular interest in connection with the subject of home accidents because of the sharp differences between the sexes in exposure to the risk of such accidents. The accident rate

[40] A multiple dwelling was one in which the entrance from the street was used in common by more than one household; all other dwellings were classified as single.

[41] The entire surveyed population, white and colored, was used in this section, except for the exclusion of those for whom age or type of rental or value of dwelling was unknown. The population (estimated, for reasons of tabulation, from a 0.5 percent sample of the punched cards) was 2,415,000, 3.6 percent of all those canvassed being excluded.

This population was fairly evenly distributed among the three types of dwellings: Rented multiple, 33.1 percent; rented single, 31.6 percent; owned, 35.3 percent. The percentage distribution by rental or value within each type was as follows:

Rental or value	Rented		Owned
	Multiple	Single	
Under $10—Under $1,000	8.6	13.5	3.8
$10 to $20—$1,000 to $2,000	33.1	38.3	11.2
$20 to $30—$2,000 to $3,000	26.6	28.2	15.2
$30 and over—$3,000 and over	31.7	20.0	69.8
	100.0	100.0	100.0

The rates in this section are not adjusted to a standard age or household-size composition.

[42] The data for all ages combined are not reproduced since they agreed so closely with the data plotted for age group 25–64.

for males rose much more rapidly with decline in dwelling rental or value than did the rate for females. For the population in rented

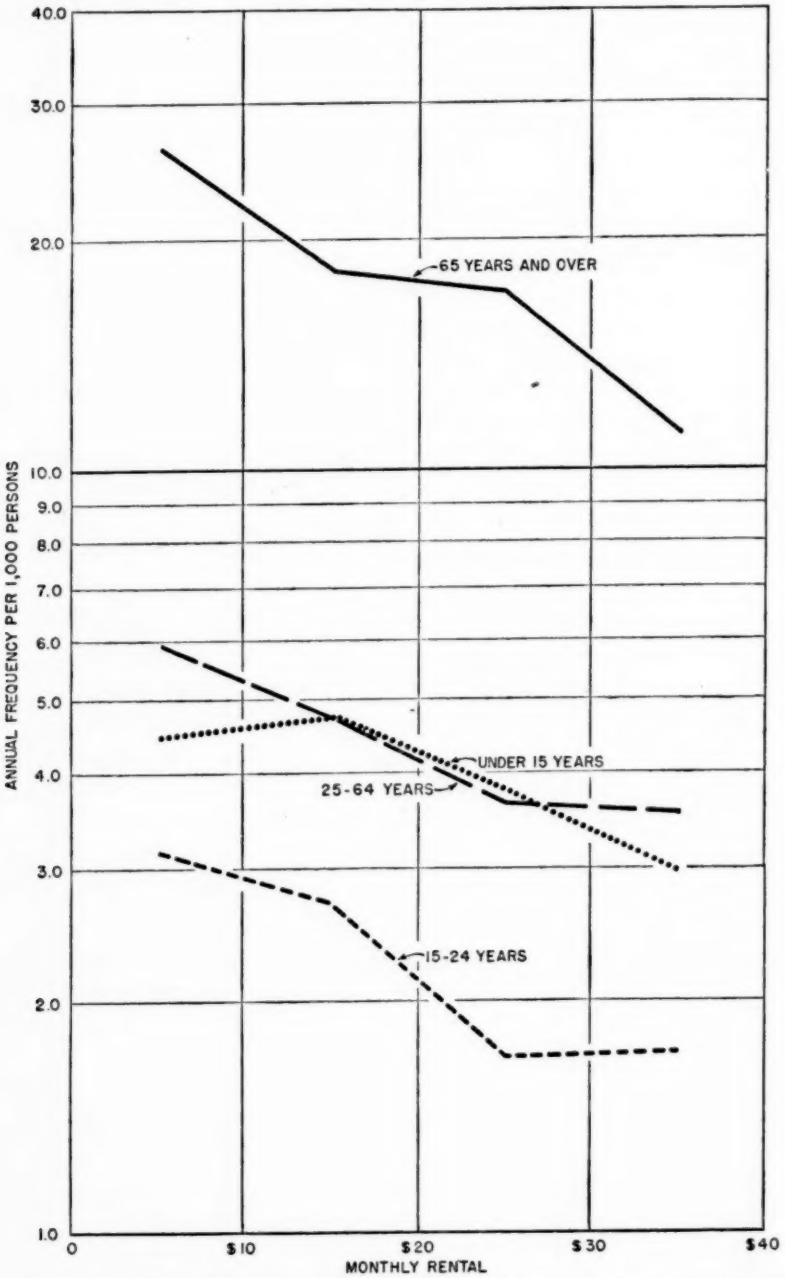

FIGURE 5.—Annual frequency of home accidents disabling for a week or longer, by age and rental. (Households in rented multiple dwellings.)

multiple dwellings the accident rate more than doubled for males as rental fell from $30 or more to $10 or less, while for females in this

group the rate increased about 50 percent. The last column of table 14 shows that there was a tendency for the differences in actual rate between the sexes to increase with increase in rental or value.

TABLE 14.—*Frequency of home accidents*[1] *disabling for a week or longer during 1 year, by ownership and type of dwelling, monthly rental or value, and sex of occupants* [2]

Ownership and type of dwelling; monthly rental or value	Sex				Ratio of rate for females to that for males (rate for males expressed as 100)
	Male	Female	Male	Female	
	Disabling home accidents per 1,000 persons		Ratio to rate for persons in dwellings of not less than $30 rental or $3,000 value (expressed as 100)		
Rented multiple dwelling:					
Under $10	4.67	6.88	209	154	147
$10 to $20	3.97	5.74	178	128	145
$20 to $30	3.09	4.18	139	93	135
$30 and over	2.23	4.48	100	100	201
All rentals	3.27	5.00			153
Rented single dwelling:					
Under $10	5.32	5.55	164	114	104
$10 to $20	4.76	5.37	147	111	113
$20 to $30	3.69	5.02	114	104	136
$30 and over	3.24	4.85	100	100	150
All rentals	4.22	5.19			123
Owned dwelling:					
Under $1,000	6.56	6.94	186	119	106
$1,000 to $2,000	4.60	7.09	130	121	154
$2,000 to $3,000	4.21	6.01	119	103	143
$3,000 and over	3.53	5.84	100	100	165
All values	3.88	6.04			156
All dwellings	3.78	5.43			144

[1] Sole, primary, and contributory diagnoses.
[2] With minor exclusions, data based on the entire surveyed population, white and colored (2,415,000 persons; males, 48 percent; females, 52 percent).

Means of injury.—Upon examination of the data classified by means of injury, as presented in table 15 and figure 6, it is not a little surprising to observe that cutting and piercing instruments and burns took relatively greater toll with lower rental or value than did falls. For rented multiple dwellings, for example, the frequency with which serious disability resulted from burns increased fourfold as monthly rental decreased from $30 or more to less than $10; disability caused by cutting and piercing instruments rose 70 percent in the same rental interval, while for falls the percentage increase was about 40. Disability from falls, so far as single dwellings are concerned, showed much less relation to rental or value than the other means of injury, there being an excess of only 19 percent in the accident rate for owned homes and a deficiency of 3 percent for rented single dwellings.

VI. SUMMARY

The National Health Survey, a house-to-house canvass covering some 2,500,000 persons in 83 representative cities, obtained certain data on illness and on housing conditions which has made possible a

study of the association between housing and health. Analysis has been divided into four sections: (1) Illness from all causes and crowd-

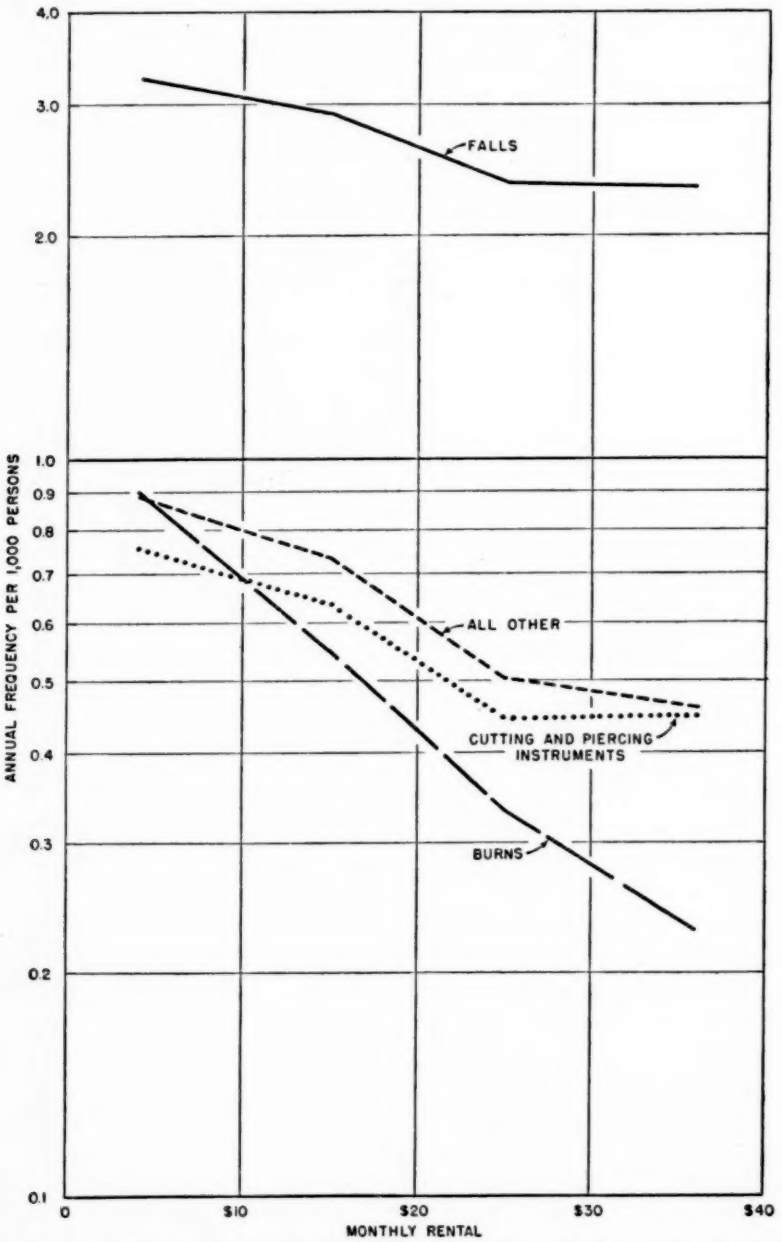

FIGURE 6.—Annual frequency of home accidents disabling for a week or longer, by means of injury and rental. (Households in rented multiple dwellings.)

ing; (2) selected diagnoses and crowding; (3) digestive diseases and toilet facilities; and (4) home accidents and rental (or value).

1. *Illness and crowding.*—The percentage of persons disabled annually for a week or longer was higher in households with more than one and a half persons per room (category *C*) than in households with one or less persons per room (category *A*). This association was found, in lesser degree, in the relief group and in the nonrelief group with annual family incomes under $1,000.

TABLE 15.—*Frequency of home accidents* [1] *disabling for a week or longer during 1 year, by ownership and type of dwelling, monthly rental or value, and means of injury* [2]

Ownership and type of dwelling; monthly rental or value	Means of injury							
	Falls	Cutting and piercing instruments	Burns	All other	Falls	Cutting and piercing instruments	Burns	All other
	Disabling home accidents per 1,000 persons				Ratio to rate for persons in dwellings of not less than $30 rental or $3,000 value (expressed as 100)			
Rented multiple dwelling:								
Under $10	3.25	0.758	0.904	0.889	142	170	395	192
$10 to $20	2.90	.626	.547	.725	127	140	239	157
$20 to $30	2.35	.442	.329	.508	103	99	144	110
$30 and over	2.29	.446	.229	.462	100	100	100	100
All rentals	2.59	.532	.419	.598				
Rented single dwelling:								
Under $10	2.65	.914	.700	1.128	97	225	232	187
$10 to $20	3.06	.731	.472	.769	112	180	156	127
$20 to $30	2.67	.544	.409	.674	98	134	135	112
$30 and over	2.73	.407	.302	.604	100	100	100	100
All rentals	2.83	.638	.451	.758				
Owned dwelling:								
Under $1,000	4.01	1.111	.432	1.049	119	221	190	174
$1,000 to $2,000	3.51	.939	.438	.866	104	187	193	143
$2,000 to $3,000	3.57	.548	.309	.748	106	109	136	124
$3,000 and over	3.37	.503	.227	.604	100	100	100	100
All values	3.44	.582	.271	.672				
All dwellings	2.97	.583	.377	.675				

[1] Sole, primary, and contributory diagnoses. With minor exclusions, data based on the entire surveyed population, white and colored (2,415,000 persons).

[2] *Falls* relates to falls of persons and includes fractures and sprains unspecified as to means of injury. *Burns* comprises burns of any type (except those from electric currents). *Cutting and piercing instruments* includes infected wounds unspecified as to means of injury. The *all other* group is made up largely of accidents caused by machinery, animals, firearms, etc., and of poisonings (gas, food, plants, etc.). Homicides and suicides (including attempts) are excluded.

At specific income levels, persons disabled by acute illness on the day of the enumerator's visit were found relatively more frequently in congested households, while the proportion of persons disabled on the day of the visit and reported as having a chronic disease or impairment evidenced little relation to crowding.

2. *Selected diagnoses and crowding.*—There was a striking increase in the pneumonia rate with increased crowding, particularly within the relief group and the next higher income group (nonrelief, under $1,000). The relief group also showed a sharp rise in the tuberculosis rate with increase in crowding. Increases were also noted for influenza and rheumatism in the two lowest income groups.

Among children under 5 years of age, the common communicable diseases of childhood (except whooping cough) evidenced greater frequency with increased crowding. But more important, each of these diseases showed an earlier age incidence in crowded households as judged by the relative frequencies in age groups under 5 and 5 to 9.

3. *Digestive diseases and toilet facilities.*—The rate for persons in households without inside flush toilets not shared by other households showed a marked excess over the rate for persons in households having such facilities. This tendency was observed in virtually every area and city-size group.

4. *Home accidents and rental (or value).*—Frequency of home accidents disabling for a week or longer increased as rental of dwelling (or value, if owner-occupied) went down. This was true for each type of abode (dwellings having been classified into "rented multiple," "rented single," and "owned"), and for each age group. Males showed a much greater rise in home-accident rate with drop in rental than was true for females.

Each means of injury showed higher rates in dwellings of low rental. Frequency of disability from burns rose more rapidly with falling rental than that from any other means. It was followed closely, however, by the rise in frequency of accidents due to cutting and piercing instruments. There was a less rapid increase in the instance of falls.

VII. COMMENT

The inferences to be drawn from this material must necessarily be somewhat speculative in nature, because of the extreme intricacy of the whole question of the relation between housing and health.

The many complicating factors the effect of which cannot be eliminated satisfactorily—differences of income, of race, of educational and intelligence level, and of housekeeping efficiency, to name but a few—constitute a serious limitation upon the interpretation of the data. The most serious limitation perhaps lies in the element economic status. Sometimes disease or impairment cuts down income, or prevents entirely the earning of a livelihood, and so forces families into poor housing, the only kind they can afford. Sometimes low income causes or perpetuates disease by making impossible an adequate diet, proper medical care (at home or in institutions), and other essentials of healthful living. With low income often goes exposure

to unhealthful occupations. As a consequence of these inextricably interwoven factors, persons badly housed have excessive rates of illness and mortality quite apart from the influence of the housing conditions themselves.

In this report an attempt has been made to eliminate the effect of economic differences by making comparisons within certain broad income classes; but it is apparent that within each of these classes, differences in effective income with degree of crowding, together with a tendency for families overburdened by disease to drift into the crowded households, have prevented the complete isolation of the effect of housing itself. In fact, it may be stated categorically that no conclusion as to the precise role of housing per se in the illness experience of low-income families is possible from the material presented in this report, or indeed from any data now available. This statement is not to be interpreted as meaning that bad housing does not affect health. It is well recognized that there are certain essentials of a healthful home environment—a sufficient supply of pure water, sanitary sewage disposal, sufficient ventilation, heat, and light, space enough for ordinary family living, absence of excessive dampness, screening against mosquitoes and flies, freedom from fire and other accident hazards, adequate playgrounds and sunshine for children. Health is more than the mere absence of outright disease; it is a state of being in which all physical and mental processes approach their highest efficiency. That is possible only under satisfactory conditions of housing.

Despite the impossibility of assessing the precise effect of housing conditions, this report has established an important broad association between housing and health. Illness rates were found to be higher in congested households, especially for certain diagnoses; disabling digestive diseases were substantially more frequent in households not having a private inside flush toilet; and serious home accidents rose with drop in rental. Essentially, because of the interrelated nature of the indices, this association is to be regarded as one between illness and poor housing generally. *What has been demonstrated most clearly is that this excess illness rate, to whatever extent it is due to bad housing itself, occurs in the low-income, poorly housed populations, who are least able to meet the burden of disease.*

VIII. APPENDIX

TABLE 1.—*Distribution of 1,769,993 white persons in 83 cities, by economic status, age, and number of persons per room*

Annual family income and relief status, and age in years	All persons per room	*A.* 1 person or less per room	*B.* More than 1 person per room, but not more than 1.5	*C.* More than 1.5 persons per room
All incomes—all ages	1,769,993	1,326,543	296,132	147,318
Under 15	472,481	286,437	117,809	68,235
15–24	301,594	212,213	60,880	28,501
25–64	917,686	756,437	112,450	48,799
65 and over	78,232	71,456	4,993	1,783
Relief—all ages	285,470	141,025	79,650	64,795
Under 15	105,933	37,694	35,332	32,907
15–24	49,615	23,374	14,969	11,272
25–64	118,839	70,796	28,172	19,871
65 and over	11,083	9,161	1,177	745
Nonrelief:				
Under $1,000—all ages	345,687	249,783	61,726	34,178
Under 15	90,765	50,145	25,261	15,359
15–24	58,259	40,069	11,943	6,247
25–64	174,115	138,392	23,589	12,134
65 and over	22,548	21,177	933	438
$1,000 to $1,500—all ages	432,206	334,511	71,498	26,197
Under 15	117,343	76,586	29,049	11,708
15–24	72,101	52,746	14,049	5,306
25–64	226,557	190,413	27,247	8,897
65 and over	16,205	14,766	1,153	286
$1,500 to $2,000—all ages	332,939	274,286	45,563	13,090
Under 15	81,369	59,300	16,785	5,284
15–24	56,058	42,690	10,188	3,180
25–64	183,477	161,242	17,773	4,462
65 and over	12,035	11,054	817	164
$2,000 and over—all ages	373,691	326,938	37,695	9,058
Under 15	77,071	62,712	11,382	2,977
15–24	65,561	53,334	9,731	2,496
25–64	214,698	195,594	15,669	3,435
65 and over	16,361	15,298	913	150

TABLE 2.—*Distribution of 31,263 white persons with record of confinement or puerperal condition disabling for a week or longer during 1 year, by annual family income and relief status, age, and number of persons per room*

Annual family income and relief status, and age in years	All persons per room	*A.* 1 person or less per room	*B.* More than 1 person per room but not more than 1.5	*C.* More than 1.5 persons per room
All incomes:				
15–24	10,716	6,953	2,509	1,254
25–64	20,547	12,595	4,886	3,066
Relief:				
15–24	2,841	1,391	831	619
25–64	4,426	1,364	1,503	1,559
Nonrelief:				
Under $1,000:				
15–24	3,207	1,983	824	400
25–64	3,888	2,108	1,056	724
$1,000 to $1,500:				
15–24	2,801	2,126	522	153
25–64	5,201	3,507	1,213	481
$1,500 to $2,000:				
15–24	1,158	919	194	45
25–64	3,758	2,877	658	223
$2,000 and over:				
15–24	709	534	138	37
25–64	3,274	2,739	456	79

FACTORS INFLUENCING THE EFFICACY OF PHENOLIZED RABIES VACCINES

II. VIRUS CONTENT OF VACCINE[1]

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The purpose of these experiments was, first, to determine the relation of the immunizing power of rabies vaccines to their virus content and, second, to find what factors in the animal passage of fixed rabies virus determine the amount of virus in the brain.

With live influenza virus, Francis (*1*) has shown a fairly strict relationship between the amount of virus in the immunizing dose and the resulting immunity in mice. The same has been shown by Webster (*2*) for rabies virus when one intraperitoneal dose of live fixed virus was given to mice.

Similar experiments have not been reported with phenolized vaccines, except that various authors have shown greater efficiency of a larger number of doses (*3*), a more concentrated emulsion (*4*) in the vaccine, and a larger amount in each dose in relation to body weight (*5*, *6*), all of which means that the more virus given the greater the immunity produced.

The question has rather recently been raised as to the possibility of the variations in the immunizing powers of different phenolized vaccines being due to variations in the amount of virus still viable after phenolization. Webster (*7*) has, to a certain degree, correlated these two factors and Lepine and Sautter (*8*) feel that the efficiency of a phenolized vaccine disappears at about the same time that it ceases to give evidence of still containing live virus. Fermi (*9*) explained the greater immunizing power of his vaccine phenolized at 23° C. over Semple's vaccine phenolized at 37° C. by the fact that there was more live virus left in the Fermi type after phenolization.

With reference to factors influencing the titer of virus in rabid animals, it is interesting to note that Lepine (*10*) has shown a decrease in the titer of cords of rabbits over a period of years as the Pasteur strain of fixed virus has been carried by intracerebral passages. At the same time there has been an increase in the virulence (titer) of the brains.

Covell and his coworkers (*11*) have demonstrated a much higher protection in monkeys immunized with a vaccine made from animal brain virus than with vaccine made from the same animal's cord.

Cumming (*12*) found that rabbits killed at the beginning of paralysis from fixed virus rabies had more virus in their brains than those killed after several days of paralysis or allowed to die.

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[1] From the Division of Biologics Control, National Institute of Health. The preceding article in the series is: Factors influencing the efficacy of phenolized rabies vaccines. I. Strains of fixed virus. Pub. Health Rep., 55: 1619–1631 (1940).

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RELATION OF AMOUNT OF VIRUS IN IMMUNIZING DOSE OF ANTIRABIES VACCINE TO IMMUNITY PRODUCED IN MICE

Amount of virus varied by dilution of phenolized vaccine.—A phenolized vaccine consisting of a 5 percent emulsion of fixed rabies virus rabbit brain with 0.5 percent phenol was prepared, using a strain of fixed virus known to be highly immunizing. A dose of 0.25 cc. of this vaccine was given intraperitoneally every second day for 6 doses to groups of 20 female Swiss mice 1 month of age (11–15 grams). One group of mice received the vaccine diluted 1:10, another 1:25, and a third 1:50. Twenty-one days from the start of the immunization each group was subdivided into lots of 4 mice each and the mice were given, intracerebrally, serial tenfold dilutions of a heterologous strain of fixed rabies virus as the test dose. Mice were observed 21 days before being discharged.

Table 1A shows irregular results in the group receiving the 1:10 dilution of vaccine owing to deaths from causes other than rabies, but apparently there was protection against 1,480 M. L. D. The vaccine diluted 1:25 and the 1:50 dilution gave but 45 M. L. D. and 59 M. L. D. protection, respectively.

TABLE 1A.—*Relation of amount of virus in immunizing dose of antirabies vaccine to immunity produced. Amount of virus varied by dilution of a single phenolized vaccine*

Dilution of vaccine [1]	Test dose dilutions fixed virus intracerebrally (Number rabies deaths/number tested)						Number of M. L. D.[2] protection (Dil. = 1 M. L. D.)
	10^{-2}	10^{-3}	10^{-4}	10^{-5}	10^{-6}	10^{-7}	
1:10	2/3	0/3	2/4	1/3	-------	-------	1,480
1:25	4/4	4/4	3/4	0/4	0/3	-------	45
1:50	4/4	4/4	2/4	1/4	0/3	-------	59
Controls	-------	-------	-------	4/4	2/4	0/4	(1/1,000,000)

[1] Six intraperitoneal doses of 0.25 cc. every 2 days to Swiss mice. Test dose on 21st day.
[2] Fifty percent end points.

Amount of virus varied in different vaccines (live virus, and phenolized virus vaccines).—In order to determine the relation of the degree of immunity produced by a vaccine to its virus content, a method was sought of varying the amount of the same strain of fixed virus in the brains of different rabbits. Then, by making vaccines from these brains, all factors (percent brain emulsion, amount of phenol) would be equal except for the virus content.

Four rabbits weighing 1,500 to 2,000 grams were injected intracerebrally with 0.2 cc. of the supernatant from a 1:10 dilution of a strain of fixed rabies virus. Rabbit 100 developed slight weakness on the fifth day, when it was killed with chloroform. Rabbit 103 also developed weakness on the fifth day and was paralyzed on the sixth day, when it was killed. Rabbit 101 had weakness on the fifth day

and was paralyzed on the sixth, seventh, and eighth days, when it was killed. Rabbit 102 showed slight weakness on the fourth day and was paralyzed on the fifth, sixth, seventh, eighth, and ninth days, when it was allowed to die.

These brains were emulsified separately and their virus content titered by intracerebral inoculation of serial tenfold dilutions into young Swiss mice (12–15 grams). Each emulsion was made up to 20 percent with normal saline, then divided into two parts. One part was then diluted to a 5 percent emulsion with normal saline solution while the other was mixed with equal parts of 2 percent phenol in saline, placed in the incubator at 37° C. for 24 hours, and then diluted to a 5 percent emulsion with 0.5 percent phenol.

Table 1B shows the vaccines thus prepared with the titers of the original brains.

TABLE 1B.—*Relation of amount of virus in immunizing dose of antirabies vaccine to immunity produced. Amount of virus varied in different vaccines*

Vaccines[1]	Number of days after inoculation rabbit killed	Titer of original brain emulsion	Test dose dilutions fixed virus intracerebrally (Number rabies deaths/number tested)								Number of M. L. D. protection (Dil. = 1 M. L. D.)
			1:10	1:20	1:100	1:1,000	1:2,000	1:100,000	1:1,000,000	1:10,000,000	
I. Brain No. 100	5	10^{-4}									
(a) Live virus vaccine			0/5	0/4	0/3	0/4	1/3				316,300+
(b) Phenolized vaccine			4/4	2/3	5/5	3/3	1/3				2,174
II. Brain No. 101	8	10^{-5}									
(a) Live virus vaccine			0/4	1/4	0/4	0/4	0/4				316,300+
(b) Phenolized vaccine			4/4	1/4	3/5	0/3	1/4				70,288
III. Controls								4/4	3/3	0/4	(1/3,163,000)

[1] 0.25 cc. of 1:10 dilution intraperitoneally on 1st, 8th, 12th, 16th, 18th, 20th, 22d, 24th, 26th and 28th days Test dose on 30th day.

The vaccines were stored at 5° C. for 21 days, during which time the titers were being completed. At that time groups of 20 one-month-old female Swiss mice were immunized with the live and phenolized vaccines made from the brain of Rabbit 100, killed on the fifth day, and the live and phenolized vaccines made from the brain of Rabbit 101, killed on the eighth day. The titer of the brain of Rabbit 100 was 10^{-4}, and that of Rabbit 101, 10^{-5}. Control mice were set aside at this time.

Mice were given 0.25 cc. of a 1:10 dilution of the vaccines on a protracted schedule because it had been previously found that repeated intraperitoneal injections of heavy emulsions of live virus in young mice will infect them with rabies. Vaccines were given at 1, 8, 12, 16, 18, 20, 22, 24, 26, and 28 days. On the thirtieth day, or 2 days after the last dose of vaccine, the test dose of a heterologous strain of fixed virus in serial tenfold dilutions was injected intracerebrally.

Table 1B shows the results with each of the four vaccines. Both vaccines containing the live virus protected against at least 316,300 M. L. D., whereas the vaccine titering at 10^{-4} when phenolized gave 2,174 M. L. D. protection as compared to 70,288 M. L. D. immunity afforded by the vaccine with a titer of 10^{-5}.

FACTORS DETERMINING TITER OF FIXED RABIES VIRUS IN BRAIN OF PARALYZED ANIMALS

Having found that the amount of virus injected tended to determine the degree of immunity produced, it became of practical importance to evaluate those factors which might influence the amount of virus in the brain of the experimental animal with fixed virus rabies.

Species of animals used.—It is known among the manufacturers of canine rabies vaccines for which sheep and horse fixed virus rabies brains are used that the titer of virus in the brains of these larger animals is usually lower than in the rabbit. The logical explanation of this is that the virus has its highest concentration in certain smaller nuclei at the base of the brain (*13*), and in emulsifying the entire brain the virus is diluted according to the ratio of the relative size of these nuclei to the rest of the brain (cerebral cortex, cerebellum, white substance), which ratio is less in the larger animals.

Amount of virus injected.—In most laboratories making rabies vaccine, at the time the animals are injected with the fixed virus a heavy emulsion is made and inoculated uncentrifuged. The apparent reason for this is to make sure that all the animals will develop the disease.

Mouse passage fixed virus was injected intracerebrally into Swiss mice weighing 20 to 25 grams. Three mice each received 1:10 emulsion uncentrifuged, 1:10 supernatant, 1:1,000 dilution of the supernatant, and 1:100,000 dilution of the supernatant. All mice were killed on the first day of definite symptoms, the brains of the 3 mice in each group being pooled and titered by intracerebral inoculation of serial tenfold dilutions in 1-month-old Swiss mice.

Table 2 shows that the 1:10 uncentrifuged original inoculation produced a titer of 10^{-5}, the 1:10 supernatant a titer of 10^{-6}, the 1:1,000 dilution 10^{-7}, and 1:100,000 dilution 10^{-6}.

This experiment was then repeated in rabbits. Rabbit 108 received 0.2 cc. intracerebrally of uncentrifuged 1:10 emulsion of a mouse passage brain of fixed virus. Rabbits 109 and 110 were injected intracerebrally with the same amount of 1:10 emulsion supernatant, and rabbits 111 and 112 with a 1:1,000 dilution of this supernatant. Rabbit 113 received 1:10,000 dilution of the supernatant.

All rabbits were killed with chloroform on the first day of complete paralysis, and the brains were removed and emulsified at 1:10 dilution. This emulsion was centrifuged at 1,000 r. p. m. for 10 minutes and

serial tenfold dilutions made in normal saline from the supernatants. Three-hundredths cc. of the 10^{-4}, 10^{-5}, and 10^{-6} dilutions for each group were injected intracerebrally into 3 Swiss mice 1 month of age.

Table 2 shows the incubation period and the titer for each type of original inoculum. The brain of the rabbit receiving the 1:10 uncentrifuged emulsion titered at 10^{-4} as did also the brains of the rabbits which received the 1:10 supernatant and 1:10,000 dilution. However, the brains of the 2 rabbits inoculated with the 1:1,000 centrifuged emulsion had a titer of 10^{-6}.

TABLE 2.—*Effect of amount of virus inoculated intracerebrally on titer of brains at time of complete paralysis*

Animal inoculated	Number of animals inoculated	Dose inoculated intracerebrally	Incubation period (days)	Titer of brains
Mouse	3	0.03 cc. 1:10 emulsion uncentrifuged	6-6-6	10^{-3}
Do	3	0.03 cc. 1:10 emulsion supernatant	6-6-6	10^{-6}
Do	3	0.03 cc. 1:1,000 emulsion supernatant	8-8-8	10^{-7}
Do	3	0.03 cc. 1:100,000 emulsion supernatant	9-10-11	10^{-6}
Rabbit	1	0.2 cc. 1:10 emulsion uncentrifuged	5	10^{-4}
Do	2	0.2 cc. 1:10 emulsion supernatant	5-5	10^{-4}
Do	2	0.2 cc. 1:1,000 emulsion supernatant	6-6	10^{-6}
Do	1	0.2 cc. 1:10,000 emulsion supernatant	8	10^{-4}
Do	3	0.2 cc. 1:10 emulsion uncentrifuged	6-6-6	10^{-3}
Do	3	0.2 cc. 1:1,000 emulsion supernatant	7-7-9	10^{-4}

The validity of these results was again tested in rabbits. Rabbits 132, 133, and 134 were given intracerebrally 0.2 cc. of a 1:10 uncentrifuged emulsion of a fixed virus. At the same time Rabbits 129, 130, and 131 received intracerebrally 0.2 cc. of the same virus emulsion supernatant diluted to 1:1,000.

Of the group receiving the heavy emulsion, Rabbit 134 died of trauma, while the other 2 animals were completely paralyzed on the sixth day. In the group inoculated with the 1:1,000 dilution of virus, complete paralysis did not develop until the seventh day in 2, and the ninth day in the third rabbit. All were killed with chloroform on the first day of paralysis.

The brains of Rabbits 132 and 133 were combined for one group and those of Rabbits 130 and 131 for the other. They were weighed, emulsified at 1:10, then diluted in salt solution in serial tenfold dilutions, 0.03 cc. of each dilution from 10^{-4} to 10^{-7} being inoculated intracerebrally in young Swiss mice. As shown in table 2, the brains of the rabbits inoculated with the 1:10 uncentrifuged emulsion titered at less than 10^{-4}, while those of the rabbits receiving the 1:1,000 dilution titered at 10^{-4}.

These results have recently been confirmed by Hampil [2] at the Sharp and Dohme Laboratories.

[2] Personal communication.

Time during disease when animals were killed.—Rabbits 80, 81, and 82 were inoculated intracerebrally with 0.2 cc. of the supernatant of a 1:10 emulsion made from a rabbit passage brain of fixed virus.

Rabbit 81 had slight weakness on the fourth day when it was killed with chloroform. Rabbit 80 was weak on the fourth day, partially paralyzed on the fifth, and completely paralyzed on the sixth day, and was then killed. Rabbit 82 likewise was weak on the fourth, partially paralyzed on the sixth, seventh, eighth, ninth, tenth, and eleventh days, and was killed on the eleventh day.

The brains of these rabbits were emulsified at 1:10 dilution, centrifuged, and serial tenfold dilutions made in normal saline from the supernatants. Three-hundredths cc. of the 10^{-3} to 10^{-6} dilutions were injected intracerebrally into 3 Swiss mice 1 month of age.

Table 3 shows that the rabbit killed on the first day of symptoms had a brain titer of 10^{-3}; that killed on the third day of symptoms had a titer of 10^{-4}; and the rabbit killed on the eighth day of symptoms had a titer of 10^{-4}.

TABLE 3.—*Effect of duration of symptoms at time rabbit killed on titer of brain*

Rabbit number	Strain of virus inoculated	Day after inoculation killed	Titer of brains
81	1	4	10^{-3}
80	1	6	10^{-4}
82	1	11	10^{-4}
100	2	5	10^{-4}
103	2	6	10^{-5}
101	2	8	10^{-5}
102	2	[1] 8	10^{-5}

[1] Died on 8th day.

This experiment was repeated, using a 1:10 centrifuged emulsion of a different strain of fixed virus. Rabbits 100, 101, 102, and 103 received 0.2 cc. intracerebrally. Rabbit 100 had weakness on the fifth day and was killed. Rabbit 103 was weak on the fifth day and paralyzed on the sixth, when it was killed. Rabbit 101 also was weak on the fifth and paralyzed on the sixth, seventh, and eighth days, when it was sacrificed. Rabbit 102 was weak on the fourth day, paralyzed on the fifth, sixth, seventh, and eighth days, when it died.

Titers of brains were done in the same manner as in the first part of this experiment and the results are shown in table 3. There was a titer of 10^{-4} when the rabbit was killed on the first day of symptoms, 10^{-5} when killed on the second day, and 10^{-5} when killed on the fourth day, and not definite but at least 10^{-5} when allowed to die.

Method of killing paralyzed animals.—In order to determine whether chloroform used in killing the paralyzed rabbit might also destroy some of the virus in the brain, Rabbits 1 and 2 were given intracerebrally 0.2 cc. of a 1:10 emulsion supernatant of a mouse passage

fixed virus. Both rabbits were completely paralyzed on the seventh day. Rabbit 7 was killed with chloroform and Rabbit 2 was bled to death. The brains of these animals were titered in the same manner previously described. Both brains had a titer of 10^{-3}.

Time interval from removal of rabies brain to emulsification.—In some laboratories the rabies brains are harvested, then placed in 50 percent glycerin in the refrigerator for a variable period before being emulsified and made up into vaccine.

Rabbit 1 was given 0.2 cc. of 1:10 emulsion supernatant intracerebrally. On the seventh day it was completely paralyzed and was killed with chloroform. The brain was divided in half. One-half was placed in 50 percent glycerin at 0° C. while the other half was emulsified and titered in young Swiss mice. One month from the removal of the brain from the rabbit the half of brain in glycerin was emulsified and similarly titered. The titer, which had originally been over 10^{-3}, had fallen to less than 10^{-2} during the 1-month storage in glycerin.

Rapidity of passage transfer.—Three Swiss mice (15–20 grams) received 0.03 cc. intracerebrally of the supernatant from a 1:10 emulsion of rabbit brain fixed virus which had been stored in glycerin for 5 months. These mice were killed on the sixth or seventh day with paralysis and the amount of virus in a single emulsion of the three brains was titered intracerebrally in Swiss mice. The titer was 10^{-4}. This 1:10 emulsion supernatant from the first mouse passage was immediately injected intracerebrally into 3 more Swiss mice. An immediate passage of a 1:10 emulsion supernatant was repeated each time the injected mice showed paralysis until the virus had been carried through 11 rapid intracerebral mouse passages.

The brains of the paralyzed mice in passage No. 11 were again titered for virus content and found to be 10^{-5}. This represented a tenfold increase over the titer of the first mouse passage.

This same procedure was repeated with a different strain of fixed virus with the exception that each mouse passage brain emulsion was made to a 1:1,000 dilution before injecting the mice of the next passage. Here both the first and tenth passage brains titered at 10^{-4}.

Titer of cord compared to brain.—Rabbit 141 was given 0.2 cc. of the supernatant of a 1:10 dilution of fixed rabies virus intracerebrally. It was killed on the sixth day when paralyzed, the brain and cord were removed and weighed. The brain weighed 8.3 gm. and the cord 3.1 gm. The brain and cord were emulsified with salt solution to a 10 percent emulsion, centrifuged, and the tenfold dilutions made. Three hundredths cc. of the 10^{-3}, 10^{-4}, 10^{-5}, and 10^{-6} dilutions were injected intracerebrally into 3 mice. The brain emulsion titered at 10^{-4} and the cord emulsion at less than 10^{-3}.

This was repeated with Rabbit 139 and here the weights of brain and cord were 11 gm. and 3.3 gm., respectively. However, both brain and cord emulsions titered at 10^{-4}.

The brain and cord of Rabbit 137 was also titered in the same way. The brain weighed 10 gm. and the cord 2.9 gm. The brain emulsion here titered at 10^{-4} and the cord at 10^{-3}.

DISCUSSION

From the results of the experiments here reported it is apparent that with any one strain of fixed rabies virus the amount of virus injected in mice, whether in the form of live or phenolized vaccine, will, in part, determine the degree of immunity produced.

In the clinical use of rabies vaccine in man the amount of virus injected can be increased by using a larger dose (usual dose 2 cc.), more doses (usual number 14 or 21), or a heavier emulsion (usual emulsion 2 to 8 percent). However, the amount of increase by these procedures is limited through physical considerations and the degree of local reaction to the subcutaneous injection of so much foreign material. Therefore, it is more desirable to increase the titer of the animal brains supplying the virus so that the amount of virus per unit weight of brain material will be greater.

From the results of these experiments the recommended technique of animal passage to produce the greatest virus content in the brains preparatory to the manufacture of rabies vaccines would be as follows:

A comparatively small animal such as the rabbit should be given intracerebrally 0.20 to 0.25 cc. of a 1:1,000 dilution of the supernatant from the previous passage brain. This animal should be killed after it has been completely paralyzed for at least 1 day, and preferably 2 days. It may be killed either by chloroform or by exsanguination and the brain on removal may be kept for a short period of time in 50 percent glycerin but probably less loss of virus will take place if it is stored in the frozen state at $-10°$ C. or lower.

Higher virus content per unit weight of nervous tissue will probably be obtained if only the brain is used in making the vaccine, the cord being discarded.

The rapidity with which the animal passages are made apparently does not influence the amount of virus present in the paralyzed rabid animal.

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COMPLEMENT FIXATION IN ENDEMIC TYPHUS FEVER

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Complement fixation in endemic typhus fever has been investigated for the purpose of determining whether this test may be of value in the diagnosis of this disease.

Castaneda (*1*) has studied complement fixation in typhus, using sera from cases of Mexican typhus and Brill's disease and from guinea pigs infected with Mexican typhus and European typhus virus. His results showed that typhus-immune sera contained complement-binding antibodies for *Rickettsia prowazeki* (Mexican type). Tests for specificity were not done except with the serum from a guinea pig infected with European typhus. Considering other rickettsial diseases, the writer has shown that complement fixation may be used in detecting "Q" fever and that results so far secured indicate that the test is specific (*2*).

Material and methods.—The sera employed in the tests were from recovered human cases of endemic typhus, Rocky Mountain spotted fever, and "Q" fever, and from guinea pigs recovered from infections with endemic typhus, European typhus, Rocky Mountain spotted fever, and "Q" fever. A number of the human sera were from cases occurring as the result of laboratory infections. Normal human and guinea pig sera were used as controls.

Antigens were prepared from the yolk sac of embryos infected according to the method of Cox (*3*) and also from the lungs of mice infected intranasally according to the method of Castaneda (*4*), except that the inoculum of the mice was heavily infected yolk sac instead of infected guinea pig tunica vaginalis. The yolk sac of chick em-

bryos became heavily infected after several passages through embryos, smears of such material showing innumerable rickettsiae. The mouse material similarly showed very numerous rickettsiae, the animals succumbing to the infection on the third day. Suspensions of rickettsiae were prepared by the method previously described (*2*). Merthiolate to a dilution of 1:10,000 was added as preservative. Both the yolk sac and the mouse lung material proved satisfactory antigens. The strain of virus used was one obtained from infected fleas on a wild rat captured in January 1941. This strain was shown by cross protection tests to be identical with the Wilmington strain which is one of the original strains of endemic typhus carried routinely in this laboratory.

The antigens were titrated with a known guinea pig serum and usually diluted 1:8, the highest dilution in which a reading of 4+ fixation was obtained.

The test.—The usual hemolytic system consisting of sheep cells, guinea pig complement, and rabbit anti-sheep-cell amboceptor was employed. The amboceptor was diluted to contain 2 units in 0.2 cc. and equal amounts of amboceptor dilution and a 5-percent dilution of sheep cells were mixed. The complement was titrated on the day of the test.

Sera were inactivated for one-half hour at 56° C. Dilutions were made ranging from 1:2 to 1:64 or to 1:256 and occasionally to 1:2,048, and 0.2 cc. of each dilution was used in the test. Complement was diluted to contain 2 units in 0.2 cc. A suitable dilution of antigen was added in 0.2 cc. amounts. Fixation was carried out for 1 hour in a 37° C. water bath, following which 0.4 cc. of sensitized cells was added to each tube and incubation continued for another hour. Readings were made the following morning after storage at cold room temperature. Complete fixation is denoted by 4 and complete hemolysis by 0.

Results.—The results obtained with human and guinea pig endemic typhus sera are shown in table 1 and tests for specificity in table 2. Table 3 shows the development of complement fixing bodies in two human typhus cases and also the results of parallel Weil-Felix tests.

TABLE 1.—*Complement fixation with endemic typhus sera*

Serum number	Time after onset	Dilutions of sera											Serum controls (no antigen)				Weil-Felix titer[1]
		1:2	1:4	1:8	1:16	1:32	1:64	1:128	1:256	1:512	1:1024	1:2048	1:2	1:4	1:8	1:16	
Human:																	
CK	5 years	4	4	4	4	4	2	1	0				0	0	0	0	
WW	9 years	3	tr.	0	0	0	0	0	0				0	0	0	0	
IB	18 months	4	4	4	4	2	0	0	0				0	0	0	0	1:160
SS	17½ months	4	4	4	4	4	3	2	1				0	0	0	0	1:160
HT	18 months	4	4	4	4	4	3	2	1				0	0	0	0	1:80
GH	17½ months	4	4	4	3	1	0	0	0				0	0	0	0	0
RB	Normal	0	0	0	0	0	0	0	0				0	0	0	0	
LH	do	0	0	0	0	0	0	0	0				0	0	0	0	
Guinea pig:																	
W8441	6 days	4	4	4	4	4	4	3	2				1	0	0	0	
WR26717	12 days	4	4	4	4	4	4	4	4	4	2	1	0	0	0	0	
W8423	13 days	4	4	4	4	4	4	3	2				tr.	0	0	0	
W8409	22 days	4	4	4	4	4	4	4	3				tr.	0	0	0	
W8406	55 days	4	4	4	4	4	4	4	4				2	tr.	0	0	
Normal		0	0	0	0	0	0	0	0				0	0	0	0	

Controls: Hemolytic system, 0; antigen, 0; sensitized cells, 4.
4=complete fixation; tr.=trace of fixation; 0=complete hemolysis.

[1] Weil-Felix titer during illness: CK, 1:20480; WW, 1:2560; IB, 1:1280; SS, 1:2560; HT, 1:40960; GH, 1:320.

Discussion.—Positive fixation was obtained with all sera from recovered human endemic typhus cases and from all guinea pigs inoculated with endemic typhus virus. Two of the human cases dated back 9 years and one of these showed 3+ fixation in dilutions up to 1:16, the other 3+ in a 1:2 dilution. A case dating 5 years ago gave 4+ fixation in dilutions up to 1:32. The group of 4 cases dating 17½ to 18 months prior to the time of drawing sera for the test all showed complete fixation in dilutions 1:8 to 1:32. In general, the results of the test with these 4 sera parallel the severity of the illness, the 2 cases SS and HT with 4+ fixation in 1:32 dilution and 3+ in 1:64 dilution being more severe than those of IB and GH, with 4+ and 3+ fixations in a 1:16 dilution.

When daily specimens of serum from typhus cases are tested, the titer of the complement fixing bodies increases beginning with the sixth or seventh day (table 3). This parallels more or less the increase in the Weil-Felix titer.

In guinea pigs complete fixation was obtained in a dilution of 1:64 in 6 days after onset of fever. In one guinea pig complete fixation in 1:512 dilution occurred on the twelfth day after the beginning of fever. Fixation in high dilutions also occurred in guinea pigs 22 days and 55 days after the beginning of fever.

TABLE 2.—*Tests for specificity*

Serum number	Disease	Date of onset	Dilutions of sera								Controls (no antigen)				Weil-Felix test
			1:2	1:4	1:8	1:16	1:32	1:64	1:128	1:256	1:2	1:4	1:8	1:16	
Human:															
RD	Endemic typhus	9 years	3	3	3	3	0	0	0	0	0	0	0	0	1:40
HT	do	18 months	4	4	4	4	4	4	3	2	0	0	0	0	1:80
PC	do	3½ months	4	4	4	4	4	4	4	1	0	0	0	0	1:640
NT	Rocky Mountain spotted fever	3 years	0	0	0	0	0	0	0	0	0	0	0	0	0
DT [1]	do	20½ months	0	0	0	0	0	0	0	0	0	0	0	0	0
JY [1]	do	9 months	0	0	0	0	0	0	0	0	0	0	0	0	1:40
TB [1]	do	7 months	0	0	0	0	0	0	0	0	0	0	0	0	0
SS	do	do	0	0	0	0	0	0	0	0	0	0	0	0	
HL	R. M. S. F. vaccine	3 inoculations	0	0	0	0	0	0	0	0	0	0	0	0	
LP	do	do	0	0	0	0	0	0	0	0	0	0	0	0	
JW	do	do	0	0	0	0	0	0	0	0	0	0	0	0	
AK	"Q" fever	3 months	0	0	0	0	0	0	0	0	0	0	0	0	
WH	do	4 months	0	0	0	0	0	0	0	0	0	0	0	0	
WJ	Normal														
Guinea pig:															
26663	Endemic typhus	21 days	4	4	4	4	4	4	4	4	0	0	0	0	
W8409	do	22 days	4	4	4	4	4	4	4	4	0	0	0	0	
B5295	European typhus	10 days	3	2	1	tr.	0	0	0	0	0	0	0	0	
B5253	do	60 days	3	3	2	1	0	0	0	0	0	1	0	0	
BR3476	Rocky Mountain spotted fever	16 days	1	0	0	0	0	0	0	0	0	tr.	0	0	
BR3423	do	72 days	1	0	0	0	0	0	0	0	0	1	tr.	0	
26628	"Q" fever	28 days	1	tr.	0	0	0	0	0	0	0	0	0	0	
25925	do	123 days	0	0	0	0	0	0	0	0	0	0	0	0	
Normal 1			0	0	0	0	0	0	0	0	0	0	0	0	
Normal 2															

Controls: Hemolytic system 0; antigen 0; sensitized cells 4.

[1] Sera received through the courtesy of Dr. G. R. Carpenter, Health Officer, Fairfax County, Va.

TABLE 3.—*Development of complement fixing antibodies*

Serum	Days after onset	Dilutions of sera								Serum controls				Weil-Felix titer
		1:2	1:4	1:8	1:16	1:32	1:64	1:128	1:256	1:2	1:4	1:8	1:16	
HT	6	0	0	0	0	0	0	0	0	0	0	0	0	1:80
	8	tr.	tr.	0	0	0	0	0	0	0	0	0	0	1:320
	9	1	1	tr.	0	0	0	0	0	0	0	0	0	1:1280
	10	4	4	3	1	tr.	0	0	0	0	0	0	0	1:2560
	11	4	4	4	4	2	0	0	0	0	0	0	0	1:5120
	12	4	4	4	4	4	3	0	0	0	0	0	0	1:10240
	13	4	4	4	4	4	4	3	1	0	0	0	0	1:10240
	14	4	4	4	4	4	4	4	3	0	0	0	0	1:20480
	15	4	4	4	4	4	4	4	4	0	0	0	0	1:20480
	16	4	4	4	4	4	4	4	4	0	0	0	0	1:40960
SS	7	2	2	1	1	0	0	0	0	0	0	0	0	1:320
	8	3	3	2	1	tr.	0	0	0	0	0	0	0	1:2560
	14	3	3	3	2	1	tr.	0	0	0	0	0	0	1:5120
Normal	-------	0	0	0	0	0	0	0	0	0	0	0	0	----------

Hemolytic system 0; antigen 0; sensitized cells 4.

The specificity of the test is shown in the results obtained with human sera from recovered Rocky Mountain spotted fever and "Q" fever cases and from individuals who had received inoculations of spotted fever vaccine. No fixation was obtained with any of these sera. A certain amount of cross fixation is shown in the results obtained with sera from guinea pigs infected with European typhus. Complement fixation tests with a European typhus antigen will probably yield more information on this phase of the subject.

Conclusions.—The results obtained in the tests described indicate the usefulness of complement fixation in detecting recent and also past infection with endemic typhus virus. The sensitivity of the test is indicated by the results with sera from cases in which infection occurred as long as 9 years ago and as recently as 7 days.

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PROVISIONAL MORTALITY RATES FOR THE FIRST 9 MONTHS OF 1940

The mortality rates in this report are based upon preliminary data for 39 States, the District of Columbia, and Alaska for the first 9 months of 1940. Comparative data for the first 9 months of 1938 and 1939 are presented for 34 States and the District of Columbia. This report is made possible through arrangement with the respective

States which voluntarily furnish provisional monthly tabulations of current birth and death statistics to the United States Public Health Service which analyzes and publishes the data. Because of lack of uniformity in the method of classifying deaths according to cause as well as some delay in filing certificates, these data are preliminary and may differ in some instances from the final figures subsequently published by the Bureau of the Census.[1]

In the past, however, these preliminary reports have accurately reflected the trend in mortality rates for the country as a whole.

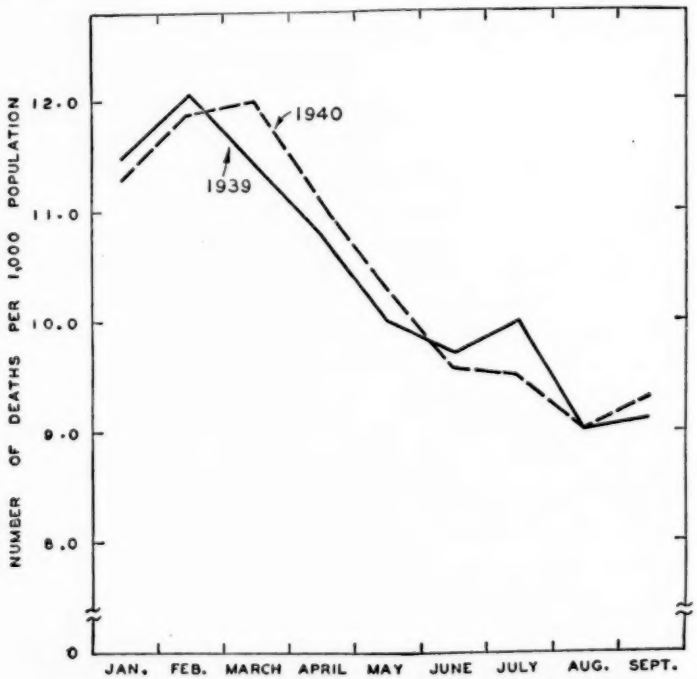

FIGURE 1.—Death rates per 1,000 population, by months, 1939 and 1940.

Some deviation from the final figures, especially those for specific causes of death, for individual States may be expected because of the provisional nature of the information. Nevertheless, it is believed that the trend in mortality within each State is correctly represented. Comparisons of specific causes of death for different States are subject to error because of variations in tabulation procedure and promptness of filing the original certificates. Such comparisons should be based upon the final figures published by the Bureau of the Census.

The death rate from all causes during the first 9 months of 1940, 10.5 per 1,000 population, was slightly less than the corresponding rate, 10.6, for 1939 and equal to the rate in 1938 when the lowest rate in the history of the registration area was reported. This low mor-

[1] Populations for all years are estimated as of July 1 from the 1930 and final counts from the 1940 Census.

tality rate is the result primarily of a relatively low prevalence of the principal communicable diseases. The mortality from influenza, although higher than in 1938, was about 13 percent less than in 1939. The death rate from pneumonia was 12 percent less than in 1939 and 19 percent less than in 1938.

The principal communicable diseases of childhood—measles, diphtheria, whooping cough, and scarlet fever—took only about 60 percent as many deaths in the first three quarters of 1940 as during the corresponding period of 1939. The decline in the mortality from tuberculosis while small, 4 percent, continued the downward trend in the mortality from this disease. Other diseases with a lower death rate in 1940 than in 1939 were typhoid fever, diarrhea and enteritis (under 2 years), and diseases of the digestive system.

Both the infant mortality and maternal mortality rates were the lowest in recent years. Unless there is a sharp rise in the maternal mortality rate during the last quarter of the year, 1940 will be the eleventh consecutive year of decline in this rate.

The minor epidemic of poliomyelitis during the third quarter of the year resulted in an increased death rate as compared with the 2 previous years. Increased death rates were observed for the principal diseases of late adult life, cancer, diabetes, cerebral hemorrhage, heart disease, and nephritis. The increase in the rates for these diseases results in part from the aging of the population.

The relative number of fatal accidents exclusive of automobile accidents has remained practically unchanged during the past 3 years. Mortality from automobile accidents, however, increased about 5 percent over 1939. This increase was widespread; 26 of the 37 States reported a higher rate for the first three quarters of 1940 than for the corresponding period of 1939.

The birth rate remained unchanged at 16.8 per 1,000 population. The crude rate of natural increase was 6.3 per 1,000 population.

Provisional mortality from certain causes in the first 9 months of 1940, with comparative provisional data for the corresponding period in preceding years

State and period	All causes, rate per 1,000 population (annual basis)	Births (exclusive of stillbirths), per 1,000 population (annual basis)	Rate per 1,000 live births: Total infant mortality	Rate per 1,000 live births: Maternal mortality	Death rate per 100,000 population (annual basis): Typhoid fever (1-2)	Cerebrospinal (meningococcus) meningitis (6)	Scarlet fever (8)	Whooping cough (9)	Diphtheria (10)	Tuberculosis, all forms (13-22)	Influenza (grippe) (33)	Measles (35)	Acute poliomyelitis and polioencephalitis (36)	Acute infectious encephalitis (lethargic) (37)	Cancer, all forms (45-55)	Diabetes mellitus (61)	Cerebral hemorrhage, embolism, and thrombosis (85a, b)	Diseases of the heart (90-95)	Pneumonia, all forms (107-109)	Diseases of the digestive system (115-129)	Diarrhea and enteritis (under 2 years) (119)	Nephritis, all forms (130-132)	All accidents, including automobile accidents (169-195)	Automobile accidents (170a, b, c)
35 STATES[1]																								
January–September:																								
1940	10.5	16.8	45	3.7	0.9	0.5	0.5	1.9	0.8	44.1	15.2	0.3	0.6	0.6	118.5	26.9	89.8	294.3	53.6	54.5	5.4	77.8	67.8	21.3
1939	10.6	16.8	47	3.9	1.4	.5	.7	2.3	1.1	45.8	17.5	.9	.4	.5	117.5	26.3	86.7	233.5	61.3	59.1	7.2	74.9	66.7	20.2
1938	10.5	17.2	50	5.0	1.5	.8	1.0	3.7	1.4	47.7	11.5	3.1	.3	.6	115.4	24.3	83.1	256.1	65.9	63.7	10.3	77.0	67.8	21.0
January–March:																								
1940	11.7	15.7	53	4.0	.5	.6	.9	1.8	1.2	45.2	32.5	.4	.3	.5	119.6	31.8	101.2	337.5	86.1	51.7	4.2	88.3	65.3	18.5
1939	11.9	16.2	55	4.2	.9	.7	1.1	2.6	1.7	47.0	33.3	1.4	.1	.5	118.5	30.4	96.8	327.0	105.4	54.6	4.1	85.1	62.4	18.1
1938	11.4	16.6	52	5.2	.7	1.2	1.5	3.4	1.5	48.5	21.9	4.2	.3	.6	114.8	26.9	90.0	292.5	104.3	55.2	4.1	83.3	63.5	19.7
April–June:																								
1940	10.3	16.5	44	3.9	.7	.5	.5	1.9	.6	46.0	10.2	.5	.2	.6	117.1	25.8	88.2	292.4	46.9	51.6	3.0	77.6	64.1	20.5
1939	10.5	16.4	47	4.0	.8	.5	.6	2.4	.7	48.4	16.3	1.2	.3	.4	117.8	26.1	85.7	281.9	52.3	57.5	6.0	75.7	66.0	18.9
1938	10.5	16.9	51	5.1	1.1	.8	1.0	4.1	1.0	49.9	8.6	4.3	.3	.6	115.7	24.4	83.7	268.6	60.2	65.0	10.3	78.9	64.0	19.2
July–September:																								
1940	9.5	18.0	40	3.3	1.5	.3	.3	1.9	.6	41.1	3.1	.2	1.3	.6	118.7	23.2	80.0	253.6	27.9	60.2	9.0	67.5	73.6	24.8
1939	9.3	17.8	41	3.6	2.4	.4	.2	2.0	1.0	42.0	3.2	.3	.9	.5	116.1	22.4	76.8	242.4	27.0	65.2	11.4	63.8	71.8	23.6
1938	9.6	18.1	47	4.7	2.7	.5	.5	3.5	1.2	44.8	4.1	.8	.4	.7	115.7	21.6	75.9	237.9	33.8	70.8	16.3	68.8	75.7	24.1
Metropolitan Life Insurance Co., industrial policy holders (January–September):[2]																								
1940	7.8	------	------	------	.7	------	.6	1.3	.8	45.3	8.7	.4	------	------	102.7	29.3	61.5	[3]161.0	38.2	------	[4]4.4	[5]57.2	46.7	[6]15.8
1939	7.8	------	------	------	.7	------	.8	1.8	1.1	45.9	11.1	.7	------	------	100.3	28.0	60.1	[3]162.0	46.6	------	[4]5.5	[5]52.0	46.2	[6]16.1
1938	7.7	------	------	------	1.0	------	1.2	2.2	1.4	47.6	7.4	2.0	------	------	95.5	24.4	57.6	[3]151.9	53.1	------	[4]7.3	[5]53.1	48.3	[6]16.9
Alaska:																								

Alaska:																							
1940	18.4	24.1	128	2.3	(7)	1.8	(7)	29.2	5.5	365.0	14.6	178.8	(7)	(7)	71.2	3.6	85.8	219.0	175.2	29.2	3.6	20.1	142.3	(7)
1939	15.0	16.7	99	3.7	(7)	(7)	11.1	29.5	1.8	341.0	24.0	3.7	(7)	1.8	75.6	3.7	59.0	213.8	132.7	40.6	(7)	29.5	143.8	(7)
1938	19.9	26.5	87	0.7	1.9	(7)	1.9	71.4	3.8	448.8	46.9	1.9	1.9	(7)	69.5	(7)	139.0	244.1	227.2	39.4	(7)	15.0	189.7	(7)
Colorado:																							
1940	10.9	19.0	52	4.1	.6	.4	.4	3.0	1.3	51.6	12.5	1.5	1.3	.7	120.3	17.7	86.6	256.0	71.0	70.9	10.1	70.1	87.6	31.4
1939	11.2	18.5	46	4.6	1.9	.8	1.1	5.6	3.0	55.9	21.8	1.6	.8	.5	116.3	17.0	88.2	237.7	86.2	65.4	9.9	76.3	87.0	25.5
1938	11.2	18.4	53	4.6	1.6	.6	1.0	3.9	3.3	61.5	13.3	3.6	.6	1.8	112.6	17.1	87.1	231.1	92.0	70.0	12.8	81.6	90.1	29.9
Connecticut:																							
1940	9.8	12.3	39	3.2	.3	.4	(7)	.3	.2	32.8	5.2	.2	.1	.2	142.5	22.2	106.1	304.2	42.5	45.2	2.1	56.8	54.4	16.6
1939	10.0	12.9	37	3.2	.4	.1	.2	1.3	.4	35.5	5.8	.6	.1	.2	140.0	29.0	83.5	281.5	47.0	48.0	2.2	77.4	58.0	16.4
1938	10.3	13.9	36	2.8	.6	.2	.3	.6	.7	36.0	4.3	(7)	(7)	.2	143.6	29.3	88.6	253.5	54.1	50.8	3.3	81.4	73.0	18.2
Delaware:																							
1940	12.4	16.9	51	4.4	1.0	1.0	1.5	2.5	(7)	49.5	12.5	(7)	.5	(7)	151.0	31.5	105.5	355.9	59.0	52.5	4.0	139.0	72.5	33.2
1939	12.1	16.4	46	4.6	2.0	2.0	.5	3.0	1.0	60.7	12.6	(7)	(7)	1.5	115.8	33.9	112.3	368.6	74.3	54.6	6.1	111.3	74.8	33.4
1938	12.2	15.8	53	6.2	.5	.5	.5	6.6	1.0	49.1	11.8	1.0	(7)	(7)	126.2	30.7	102.7	364.9	73.6	61.8	9.7	108.5	81.8	27.6
District of Columbia:																							
1940	12.9	22.3	45	3.0	1.0	.8	.2	1.8	.4	66.8	7.8	(7)	.4	.8	148.9	34.2	92.7	339.2	81.2	81.0	9.8	117.9	70.6	20.4
1939	12.7	21.6	47	5.1	.2	.8	(7)	2.1	.6	69.1	10.7	.4	(7)	.2	156.2	26.1	78.4	332.3	73.7	80.9	11.7	105.3	75.1	21.8
1938	12.6	20.2	49	5.2	.8	1.7	.6	.6	.8	74.2	5.1	.4	.4	.6	138.9	23.3	84.0	335.0	89.7	76.6	12.3	102.1	67.5	20.7
Florida:																							
1940	12.1	16.4	56	7.0	1.2	.4	.1	1.8	1.0	51.8	31.9	.4	.3	.3	95.7	19.2	112.0	293.4	57.8	68.6	7.1	90.4	93.9	34.2
1939	11.1	16.1	59	6.6	1.4	.6	.2	3.4	1.6	49.0	23.3	.9	.4	.2	91.2	19.4	92.2	235.3	52.6	77.2	11.8	90.8	89.5	34.5
1938	11.4	15.9	59	7.7	3.1	1.0	.1	4.0	1.8	53.7	20.4	1.8	.7	.6	83.9	17.9	91.4	232.7	64.0	83.6	12.8	89.2	91.6	36.5
Georgia:																							
1940	10.0	19.8	59	5.3	2.0	.3	.5	2.9	1.5	48.5	33.8	.9	.2	(8)	60.5	10.9	93.1	192.3	66.5	49.0	13.3	102.5	59.6	20.7
1939	9.6	19.4	62	5.8	2.7	.4	.4	4.2	1.9	46.9	29.6	2.1	.4	.1	60.0	11.4	90.3	162.8	67.9	59.2	14.8	90.0	53.7	18.5
1938	10.6	19.9	70	6.7	4.5	.8	.3	7.9	2.3	51.8	24.4	6.1	.6	.3	60.3	12.7	84.7	164.8	82.4	73.9	24.3	111.4	64.2	23.7
Idaho:																							
1940	9.0	22.5	36	3.4	.8	1.0	.8	1.8	.3	18.0	13.2	1.3	.8	1.0	88.3	17.5	57.4	232.5	31.5	56.4	5.8	54.8	102.8	36.8
1939	9.2	21.6	45	2.5	3.1	1.5	.5	2.3	1.0	18.8	15.5	1.0	.5	1.5	89.0	21.2	61.9	240.2	59.1	54.2	4.4	49.8	95.2	30.7
1938	8.8	22.5	42	3.6	1.8	1.8	.8	3.4	.5	20.4	16.2	.8	.3	1.3	81.8	13.1	63.4	180.8	73.1	55.8	3.7	55.3	84.9	31.7
Illinois:																							
1940	11.2	15.2	36	3.0	.5	.2	1.0	.7	1.1	47.1	9.0	.2	.4	.4	141.5	33.5	82.9	352.7	47.6	60.0	2.5	92.6	72.1	27.3
1939	11.1	14.7	39	3.1	1.4	.2	1.0	2.2	1.5	47.6	14.7	.1	.3	.3	140.8	29.7	74.3	338.1	56.7	61.8	3.3	94.4	66.6	24.4
1938	10.6	15.3	41	3.3	.7	.3	1.8	1.7	1.4	46.8	5.3	3.5	.2	.4	135.6	27.5	72.6	308.9	55.8	65.1	6.2	91.8	72.2	24.1
Indiana:																							
1940	11.5	16.6	42	3.0	.8	.2	1.2	2.6	.9	38.9	24.7	.1	2.3	.5	121.5	15.4	143.8	310.7	58.6	(9)	3.3	79.3	79.5	29.8
1939	11.2	15.8	42	4.1	1.3	.4	1.5	1.8	1.4	41.9	31.1	.2	.2	.5	113.5	16.6	131.5	250.1	73.9	(9)	5.8	63.1	72.1	27.4
1938	10.8	16.3	43	4.2	.7	.8	1.9	1.7	1.9	40.4	11.8	4.1	.3	.6	113.5	16.3	120.4	235.6	66.6	(9)	8.9	64.8	73.5	29.7
Iowa:																							
1940	10.0	15.8	38	3.7	.4	.6	.7	.9	.6	17.0	18.9	.5	2.1	.8	130.4	26.2	107.0	287.2	48.6	51.3	1.9	65.6	63.1	18.7
1939	10.1	17.1	37	2.4	.7	.5	1.1	1.8	.5	18.8	29.3	1.4	.5	.6	124.9	25.5	103.1	268.9	54.2	56.9	2.4	54.6	65.6	18.7
1938	9.5	16.5	37	3.3	.6	.7	2.2	2.8	.8	19.4	12.1	1.3	.5	1.1	126.9	21.4	97.7	240.2	57.3	57.2	3.6	56.4	64.2	16.6
Kansas:																							
1940	10.5	15.7	38	4.1	.6	.6	.5	1.6	.7	25.1	21.5	1.1	2.2	1.0	123.2	26.0	101.8	276.5	35.7	57.9	4.1	101.4	77.1	25.5
1939	10.3	15.8	40	4.0	.7	.4	.7	.6	.4	23.0	19.3	.1	.2	1.4	123.6	27.0	97.7	256.9	46.1	61.7	4.2	98.8	102.6	21.6
1938	10.1	16.0	42	4.1	.9	.4	1.5	3.2	.5	23.9	16.0	1.7	(7)	1.0	122.4	24.1	97.7	232.6	49.3	63.3	5.2	97.3	102.8	23.1

See footnotes at end of table.

Provisional mortality from certain causes in the first 9 months of 1940, with comparative provisional data for the corresponding period in preceding years—Continued

State and period	All causes, rate per 1,000 population (annual basis)	Births (exclusive of stillbirths), per 1,000 population (annual basis)	Rate per 1,000 live births		Death rate per 100,000 population (annual basis)																	
			Total infant mortality	Maternal mortality	Typhoid fever (1-2)	Cerebrospinal (meningococcus) meningitis (6)	Scarlet fever (8)	Whooping cough (9)	Diphtheria (10)	Tuberculosis, all forms (13-22)	Influenza (grippe) (33)	Measles (35)	Acute poliomyelitis and polioencephalitis (36)	Acute infectious encephalitis (lethargic) (57)	Cancer, all forms (45-55)	Diabetes mellitus (61)	Cerebral hemorrhage, embolism, and thrombosis (83a, b)	Diseases of the heart (90-95)	Pneumonia, all forms (107-109)	Diseases of the digestive system (115-129)	Diarrhea and enteritis (under 2 years) (119)	Nephritis, all forms (130-132)	All accidents, including automobile accidents (169-195)	Automobile accidents (170a, b, c)
35 STATES—continued																								
Kentucky:																								
1940	10.3	20.8	52	4.0	2.3	1.1	.8	4.6	1.5	67.2	30.2	.6	1.4	.5	83.6	13.9	106.4	215.3	59.5	58.0	12.0	72.5	76.8	23.3
1939	9.9	20.6	49	4.2	4.0	1.3	1.0	1.8	2.2	64.9	36.8	1.4	.7	.7	77.0	12.3	97.3	206.4	68.0	65.9	19.5	64.1	71.1	20.3
1938	9.6	23.4	51	4.0	4.0	2.3	1.4	7.7	2.6	70.3	23.4	5.0	.9	.2	71.4	13.3	97.0	185.8	69.8	84.3	34.3	70.6	59.2	20.7
Louisiana:																								
1940	11.1	20.6	64	5.8	3.9	.6	.1	7.2	1.4	60.5	34.0	.7	.7	.2	87.4	19.0	69.6	251.6	78.1	64.0	14.0	87.2	68.8	21.4
1939	10.3	19.7	62	6.1	6.6	.5	.2	4.8	2.2	60.2	24.8	5.3	.5	.3	75.8	16.0	67.8	210.3	80.6	68.5	13.3	91.9	60.1	17.5
1938	10.4	20.0	66	6.4	5.4	1.0	.3	4.3	2.4	63.3	22.9	.7	.3	.5	80.5	16.2	61.4	194.3	83.2	72.2	17.0	92.7	63.5	18.5
Maine:																								
1940	12.0	17.5	53	4.1	.6	1.3	.9	2.0	.8	28.2	12.3	1.4	.3	.3	146.7	29.8	124.4	356.6	50.9	53.5	5.0	87.7	70.8	20.9
1939	12.8	17.9	52	4.0	1.3	.2	.3	3.3	2.5	33.9	22.5	.6	1.0	.5	150.1	26.2	128.7	381.1	78.6	53.6	5.5	79.7	71.8	20.9
1938	12.2	18.2	49	4.3	1.9	(7)	(7)	2.4	1.4	30.5	16.4	2.1	.6	.2	147.8	27.9	115.3	340.3	74.8	59.2	8.8	85.0	64.7	19.3
Maryland:																								
1940	12.3	16.6	49	2.7	.5	.4	.4	3.4	.3	82.9	9.7	.1	.3	.4	139.0	31.7	97.7	351.7	66.6	50.0	5.3	131.4	76.4	24.2
1939	11.6	15.8	49	3.2	1.0	.7	.1	1.1	1.0	73.6	10.4	1.2	.1	.4	132.1	27.9	94.2	312.2	70.1	53.6	7.7	116.8	69.4	21.0
1938	11.6	16.4	57	3.8	1.6	.9	.6	3.1	.7	74.5	7.6	.6	.1	1.0	127.0	27.3	94.7	301.0	76.4	59.4	11.7	123.0	68.1	20.2
Massachusetts:																								
1940	11.7	(8)	(8)	(8)	.3	.2	.2	.3	.2	38.9	3.4	.3	(8)	.3	171.1	36.3	103.9	414.4	60.0	53.3	2.3	71.5	60.9	13.8
1939	11.4	(8)	(8)	(8)	.4	.5	.4	1.3	.2	37.2	6.3	.5	(8)	.2	157.4	35.5	101.4	402.0	74.9	54.6	2.1	65.1	59.1	12.8
1938	11.3	(8)	(8)	(8)	.3	.6	.7	.9	.3	39.0	3.8	.3	.3	.2	159.2	33.1	98.8	369.8	76.7	56.2	2.7	70.5	60.8	14.2
Michigan:																								
1940	9.8	18.5	41	3.3	.2	.2	.9	1.0	.4	34.8	5.0	.4	1.3	.3	116.9	27.0	91.4	293.1	44.6	53.7	3.5	54.9	73.4	29.9
1939	10.0	18.0	42	3.1	.5	.3	1.6	1.6	.5	36.9	18.1	.7	.8	.2	115.3	26.0	82.2	284.7	56.0	56.9	4.8	54.3	70.2	23.6
1938	9.6	18.6	44	3.6	.5	.4	1.8	2.4	.7	37.8	5.9	2.5	.2	.2	109.5	24.3	82.9	261.3	53.0	58.5	6.3	52.1	66.6	24.1
Minnesota:																								

Minnesota:																								
1940	9.5	18.7	33	2.4	.2	.2	.6	1.1	.2	27.4	9.5	.2	.7	.6	133.1	26.4	89.3	272.3	57.9	50.4	2.3	38.8	66.6	20.6
1939	9.6	17.8	37	2.7	.1	.2	.5	.5	.4	30.4	14.3	3.1	1.4	.4	135.1	25.7	91.1	251.7	60.0	55.6	3.6	38.6	66.9	18.8
1938	9.2	17.3	38	3.2	.3	.3	1.1	2.2	.4	28.2	8.1	.7	.3	.7	136.0	24.0	82.4	229.1	61.0	52.6	3.0	40.8	67.7	22.5
Mississippi:																								
1940	10.4	(9)	(9)	(9)	1.6	.8	.1	6.4	1.9	46.2	43.9	.3	.7	.5	62.1	13.3	71.9	155.7	45.7	60.9	16.1	102.3	71.2	17.6
1939	10.1	(9)	(9)	(9)	2.3	1.2	.1	7.2	2.0	50.3	41.6	4.7	.8	.3	60.9	12.1	71.6	155.9	56.4	62.0	15.6	90.7	67.0	17.6
Montana:																								
1940	10.0	20.4	43	3.3	.7	1.0	2.1	.7	1.0	41.3	12.6	1.2	1.0	2.1	111.2	10.5	97.6	230.4	47.5	71.8	6.4	56.8	90.2	24.1
1939	10.6	19.5	52	3.4	2.4	1.2	1.0	3.6	1.2	44.8	21.6	3.8	(7)	1.2	116.2	19.2	89.9	226.7	67.8	65.9	4.8	55.8	94.2	25.9
1938	10.2	19.3	42	3.6	.7	1.9	1.9	3.9	1.9	43.6	20.7	1.4	.2	5.5	95.3	15.6	86.1	208.6	75.1	66.2	6.0	50.5	101.3	23.3
Nebraska:																								
1940	9.7	16.7	35	3.1	.4	.3	.9	.4	.6	18.3	20.8	.4	.8	.5	127.6	26.9	106.2	238.6	46.8	54.4	2.6	65.2	65.6	17.4
1939	9.3	16.5	34	3.4	.5	.2	1.0	1.3	.9	17.2	19.5	1.4	.4	.4	116.0	25.0	91.0	206.1	56.2	57.1	2.2	67.7	72.2	21.0
1938	9.0	16.5	37	3.3	.5	.5	1.3	2.7	.9	17.2	11.3	.9	.4	.8	123.6	25.2	85.3	223.1	54.2	51.6	2.6	61.7	58.8	17.6
Nevada:																								
1940	12.0	19.0	47	5.1	(7)	1.2	(7)	3.6	1.2	68.8	7.2	(7)	1.2	(7)	111.0	20.5	66.3	304.0	65.1	71.2	3.6	57.9	160.4	70.0
1939	11.1	17.0	43	5.1	1.2	1.2	(7)	(7)	(7)	50.4	6.1	2.5	(7)	(7)	102.0	9.8	71.3	265.4	87.2	38.1	4.9	41.8	195.4	68.8
1938	11.3	16.9	36	2.2	3.8	(7)	(7)	1.3	3.8	67.5	1.3	(7)	(7)	(7)	90.1	12.5	71.3	263.9	96.3	60.0	5.0	72.5	128.8	55.0
New Jersey:																								
1940	10.9	14.2	36	2.8	.4	.1	.5	.5	.5	43.8	4.8	.3	.1	.4	143.8	36.7	90.7	360.3	46.3	54.7	2.3	78.1	63.1	19.5
1939	10.5	13.8	39	3.0	.4	.4	.5	1.3	.5	45.0	6.8	(7)	.7	.6	137.8	33.4	85.2	352.0	49.6	56.4	2.8	68.3	56.8	18.3
1938	10.5	13.7	39	3.4	.4	.5	.3	1.2	.8	48.0	5.0	1.0	.2	.7	132.1	29.9	83.5	332.2	59.6	60.0	3.2	73.0	61.1	20.5
New Mexico:																								
1940	10.6	31.0	88	4.7	2.2	.5	.2	10.2	1.5	74.7	12.5	1.0	.5	(7)	56.2	10.2	42.0	116.5	52.0	87.2	42.7	49.5	89.7	40.7
1939	11.0	30.0	98	4.3	2.8	1.3	.5	7.1	3.6	71.5	24.3	1.0	1.3	(7)	53.1	7.9	38.6	107.2	87.6	84.8	36.0	48.5	82.5	36.0
1938	10.8	29.2	93	4.9	3.1	.5	.8	14.3	2.6	75.3	11.7	13.0	.8	(7)	54.7	6.0	41.7	110.5	70.4	93.9	39.9	52.9	77.2	27.6
New York:																								
1940	10.9	14.7	37	3.1	.2	.4	.3	1.1	.1	47.7	3.3	.1	.1	.9	157.0	40.6	72.5	385.5	47.0	58.0	3.0	66.2	61.5	16.5
1939	11.3	14.3	39	3.0	.4	.5	.4	.9	.3	49.0	4.7	.5	.3	.5	152.9	39.8	66.3	365.0	59.5	60.8	4.5	67.7	60.8	16.0
1938	11.0	14.4	41	3.8	.4	.8	.6	1.4	.3	50.3	3.6	.9	.2	.7	149.9	35.4	62.8	350.9	64.1	61.1	5.1	70.3	62.8	17.0
North Carolina:																								
1940	9.1	22.5	58	5.7	1.1	.3	.3	2.1	2.5	50.5	25.9	.4	.4	.4	57.7	14.0	85.4	153.4	61.2	52.4	12.9	97.6	61.5	23.4
1939	8.9	22.4	59	5.2	1.4	.5	.4	7.4	2.6	51.1	19.4	2.2	.2	.2	54.8	13.0	79.9	157.9	60.9	64.9	20.2	81.1	61.4	23.6
1938	9.7	22.8	68	6.1	2.3	.9	.5	8.4	3.6	55.4	14.0	9.1	.3	.4	54.8	10.6	79.3	162.2	76.6	80.3	33.1	90.2	61.3	22.6
North Dakota:																								
1940	7.9	21.1	39	1.5	.6	(7)	1.0	1.9	1.7	19.6	10.2	.2	.2	1.7	97.5	23.3	70.6	206.7	39.2	51.9	5.4	41.3	53.6	17.1
1939	7.8	20.9	45	2.7	.8	.6	1.0	2.1	.8	21.4	21.6	4.1	(7)	.8	86.0	20.9	70.7	192.0	55.8	48.9	6.2	39.0	43.5	11.8
1938	8.0	20.5	47	2.5	.2	1.6	3.3	10.1	.8	23.3	10.7	3.1	(7)	5.2	98.1	22.3	65.9	156.8	55.0	55.6	6.6	43.9	52.8	17.3
Ohio:																								
1940	11.4	16.5	38	3.6	.8	.4	.7	1.7	.4	40.6	15.0	(7)	.6	.5	136.1	30.9	112.7	316.2	54.5	54.2	4.2	78.1	86.9	27.0
1939	11.2	15.5	42	5.8	.7	.2	1.1	1.3	.8	43.3	21.7	.1	.2	.6	131.4	28.4	107.9	295.8	62.1	56.3	5.2	76.8	80.8	24.9
1938	10.8	16.5	44	3.9	.8	.7	1.3	2.0	1.1	47.6	11.2	3.4	.2	.4	127.1	26.6	102.0	270.5	60.0	59.6	7.0	74.3	77.4	25.1
Oklahoma:																								
1940	8.7	18.7	47	3.6	2.4	1.1	.3	2.1	2.2	47.4	23.6	.2	1.5	.7	81.9	14.2	80.6	161.6	55.5	59.7	10.0	62.5	56.1	18.8
1939	9.1	18.6	55	4.4	4.1	.5	.9	1.2	2.5	46.6	23.8	4.3	.4	.6	78.3	13.9	87.1	155.2	65.6	64.7	10.1	58.1	87.6	21.3
1938	8.7	19.2	42	4.2	4.4	1.1	.7	9.5	4.4	49.6	18.1	2.8	1.3	.3	76.4	13.6	70.2	139.7	61.8	63.5	10.5	63.6	72.4	22.6
Pennsylvania:																								
1940	11.0	16.3	43	2.7	.6	.7	.5	1.2	.4	40.5	12.2	.1	.3	.6	124.2	35.6	84.6	336.5	51.1	54.9	3.7	96.6	56.5	15.3
1939	10.7	16.5	44	3.3	.6	.6	.6	1.6	.6	41.3	14.0	.1	.4	.7	124.2	33.8	82.9	321.6	52.3	53.4	4.7	84.4	52.9	14.2
1938	10.8	17.0	46	3.6	.9	.7	1.3	1.7	.8	42.6	10.4	3.1	.1	.7	121.0	30.8	82.1	306.3	61.8	58.0	5.7	82.6	58.6	15.9

See footnotes at end of table.

Provisional mortality from certain causes in the first 9 months of 1940, with comparative provisional data for the corresponding period in preceding years—Continued

State and period	All causes, rate per 1,000 population (annual basis)	Births (exclusive of stillbirths), per 1,000 population (annual basis)	Rate per 1,000 live births		Death rate per 100,000 population (annual basis)																				
			Total infant mortality	Maternal mortality	Typhoid fever (1–2)	Cerebrospinal (meningococcus) meningitis (6)	Scarlet fever (8)	Whooping cough (9)	Diphtheria (10)	Tuberculosis, all forms (13–22)	Influenza (grippe) (33)	Measles (35)	Acute poliomyelitis and polioencephalitis (36)	Acute infectious encephalitis (jethargic) (37)	Cancer, all forms (45–55)	Diabetes mellitus (61)	Cerebral hemorrhage, embolism, and thrombosis (834, b)	Diseases of the heart (90–95)	Pneumonia, all forms (107–109)	Diseases of the digestive system (115–129)	Diarrhea and enteritis (under 2 years) (119)	Nephritis, all forms (130–132)	All accidents, including automobile accidents (169–195)	Automobile accidents (170a, b, c)
35 STATES—continued																									
Rhode Island:																									
1940	11.2	15.2	38	2.5	1.3	.9	(*)	.4	.4	32.9	4.3	.6	.4	.2	160.3	38.7	99.5	368.7	54.6	54.8	1.9	96.0	49.2	10.9
1939	10.9	14.6	39	3.2	(*)	.4	(*)	2.6	.2	39.7	6.4	.2	(*)	(*)	152.2	32.3	85.9	354.8	62.2	61.5	4.3	95.5	49.1	10.1
1938	11.8	15.2	41	2.1	.4	.9	.4	1.3	.2	40.6	4.9	.2	(*)	.2	153.5	39.6	93.2	340.7	85.4	58.3	3.8	105.3	100.9	11.3
South Carolina:																									
1940	10.7	21.6	73	6.8	3.8	.4	.1	2.2	2.0	47.8	39.2	.8	.6	.3	56.4	12.8	102.6	205.5	68.1	53.8	7.4	93.6	73.7	28.2
1939	9.6	20.1	71	6.1	5.3	.4	.1	7.7	2.3	42.7	26.9	.6	2.8	.2	50.5	12.6	90.4	178.2	61.8	42.9	7.7	84.4	60.5	23.5
1938	10.7	20.3	86	8.2	6.4	.7	.5	15.4	1.9	48.8	30.4	9.9	.6	.4	52.4	11.9	90.4	182.6	82.9	43.1	13.2	87.9	60.1	22.3
Tennessee:																									
1940	10.2	17.8	56	5.4	2.1	.6	.5	3.6	1.1	74.9	35.8	.8	.1	.6	71.8	14.2	85.0	195.4	75.1	60.7	10.6	61.6	62.7	16.2
1939	9.6	16.9	55	5.5	3.0	.6	.6	3.3	1.6	79.2	36.3	1.5	.6	.7	69.8	12.6	79.8	169.3	69.0	66.7	13.7	58.9	60.0	17.3
1938	9.7	17.1	66	5.8	3.6	1.5	.4	7.4	2.6	77.4	25.4	9.1	.7	.6	69.1	10.4	78.0	160.7	76.3	78.5	23.9	62.6	60.0	18.4
Texas:																									
1940	9.5	(*)	(*)	(*)	3.5	.4	.2	4.3	2.0	58.2	28.2	4.1	.6	.5	74.9	14.1	62.2	179.4	54.7	88.2	34.5	56.6	66.1	24.4
1939	8.8	(*)	(*)	(*)	4.6	.3	.3	4.1	2.2	58.3	23.6	1.6	1.1	.3	66.8	12.0	60.8	163.0	57.5	(*)	29.1	53.1	61.8	21.9
Utah:																									
1940	8.5	24.5	37	2.8	.5	.5	1.5	2.4	(*)	15.0	12.8	1.0	1.2	.5	90.6	18.9	58.4	236.2	35.1	53.8	3.4	47.5	81.4	32.9
1939	8.2	23.1	39	3.2	.5	.7	.2	1.0	.5	15.6	8.8	.2	1.0	.5	93.1	17.1	53.8	227.3	43.5	52.3	1.7	53.0	72.8	28.3
1938	8.6	24.5	42	3.7	.5	1.7	1.2	3.7	1.5	21.2	9.6	2.5	(*)	.2	83.7	18.0	49.3	218.7	55.4	58.1	2.2	49.7	89.9	34.2
Vermont:																									
1940	11.1	18.3	32	3.9	1.1	.7	(*)	2.2	(*)	36.6	12.3	(*)	.4	(*)	136.3	24.7	117.3	318.6	65.7	51.9	6.0	75.8	55.3	16.4
1939	11.7	15.8	36	3.3	(*)	.4	1.1	7.1	1.1	40.7	28.4	1.1	1.1	.4	143.9	31.8	116.2	372.9	85.6	51.9	3.4	80.7	68.0	19.1
1938	11.2	16.0	42	3.0	.4	(*)	.4	3.4	4.9	38.8	14.2	4.5	1.5	.4	127.0	28.4	107.6	313.7	84.8	55.3	2.6	83.3	65.7	20.5

Virginia:

Virginia:																							
1940	11.1	19.8	59	4.7	.9	1.3	.3	4.0	1.7	60.4	29.3	1.0	.6	.8	80.4	20.5	101.8	251.3	72.1	48.7	8.6	106.8	82.1	28.2
1939	10.6	19.3	63	5.1	1.7	1.0	.3	6.0	2.7	62.3	24.2	1.1	.3	.3	79.2	17.2	102.6	241.7	67.0	53.3	11.2	86.4	70.6	27.2
1938	10.8	19.6	72	5.2	2.3	1.7	.3	7.9	2.5	69.6	18.7	4.5	.4	.2	78.7	16.0	94.9	230.7	69.5	62.0	18.5	82.3	68.7	23.0
West Virginia:																								
1940	8.9	20.2	52	4.5	1.8	1.5	.9	5.3	2.0	46.2	19.9	(7)	1.6	.4	72.8	16.4	77.4	167.2	53.2	42.9	6.1	66.1	83.5	18.2
1939	9.0	20.3	55	3.6	3.1	2.1	.9	2.1	2.0	45.4	21.3	.4	.3	.7	73.0	16.1	76.5	168.4	61.6	60.3	16.0	65.0	72.6	16.1
1938	9.2	21.3	64	3.7	3.4	2.0	1.7	8.9	2.0	50.2	20.2	8.0	.9	.6	72.0	15.4	68.9	161.3	69.9	70.0	24.9	68.1	73.4	18.1
Wisconsin:																								
1940	10.1	17.4	37	2.8	.2	.2	.9	.9	.2	25.8	13.4	.4	1.0	.8	134.7	28.5	96.2	299.2	49.1	(9)	3.3	57.7	76.6	23.0
1939	10.2	17.2	42	2.8	.2	.3	1.1	1.6	.1	27.7	21.0	.9	.4	.2	127.3	27.3	87.1	301.2	51.0	(9)	4.7	58.4	74.2	21.0
1938	9.7	17.5	42	2.9	.2	.3	1.2	1.7	.4	29.3	6.5	1.5	.2	.3	129.7	27.5	83.4	270.6	52.1	(9)	4.8	60.1	65.5	19.6
Wyoming:																								
1940	8.2	19.5	42	4.4	.5	2.7	.5	.5	1.6	14.9	5.8	3.2	.5	1.1	83.4	13.8	68.0	192.4	32.4	52.6	3.2	54.7	103.2	52.1
1939	8.9	19.5	49	4.1	2.7	1.1	(7)	.5	1.1	23.6	12.9	.5	.5	(7)	79.0	12.4	58.6	211.1	46.7	65.0	4.3	67.2	106.4	42.4
1938	8.9	19.2	54	3.7	2.2	1.1	.5	15.7	1.6	24.4	15.7	(7)	(7)	.5	82.0	11.4	58.1	193.8	65.7	65.7	8.1	56.4	112.3	37.4

[1] Includes all States except Michigan, Nebraska, and Rhode Island, with data for the 9-month period of 1940, 1939, and 1938. The District of Columbia is included as a State. Estimated population July 1, 1940, 98,175,700.

[2] These data are taken from the October 1938, 1939, and 1940 Statistical Bulletins published by the Metropolitan Life Insurance Co. All figures are provisional and are subject to correction, since they are based on provisional estimates of lives exposed to risk. Data do not include all diseases reported to the Public Health Service.

[3] Excludes pericarditis, acute endocarditis, and acute myocarditis.

[4] Classified as diarrhea and enteritis, age not specified.

[5] Chronic nephritis only.

[6] Excludes collisions between automobiles and trains or street cars.

[7] No deaths reported.

[8] Less than 0.1 per 100,000 population.

[9] Data not available.

U. S. PUBLIC HEALTH SERVICE ORIENTATION COURSE FOR PERSONNEL TO SERVE IN HEALTH AND SANITATION ACTIVITIES IN CONNECTION WITH NATIONAL DEFENSE

The Surgeon General of the U. S. Public Health Service is now setting in motion a plan for inducting into the Service as rapidly as possible approximately 250 public health workers, in order to deal with the emergency public health and sanitation problems in and around cantonment areas.

Plans have been completed for carrying on an orientation course for doctors, nurses, engineers, and laboratory workers at the National Institute of Health, Bethesda, Md., beginning April 7, 1941.

The national defense emergency makes it necessary for the Public Health Service to mobilize immediately a corps of public health workers to augment State and local health services in areas where defense activities have created unusual health and sanitation problems.

The Surgeon General has assigned from the Public Health Service Senior Surgeon Mark V. Ziegler as the Director of the orientation course with Miss Mary J. Dunn, Nursing Consultant, and Ellis S. Tisdale, Sanitary Engineer (R), to assist with the nursing and engineering aspects of the work.

Headquarters for the staff have been established in the Administration Building, National Institute of Health, Bethesda, Md.

The course will start April 7, 1941. It will consist of two parts, classroom instruction for 3 weeks, and field observation and practical application activities for about 2 weeks. The field work will be in a restricted area in Maryland. The Demonstration Defense Area will include facilities for demonstrating public health practices and methods in respect to:

1. Communicable disease control, emphasizing the prevention of the spread of venereal diseases.
2. Public health administration as it relates to defense activities.
3. Environmental sanitation.
4. Industrial hygiene in respect to the production of defense materials.

Surgeon L. B. Byington has been assigned to organize and direct the field activities in the demonstration area.

An advisory council consisting of the following persons has been appointed by the Surgeon General to assist in guiding this orientation course.

Dr. Milton J. Rosenau, University of North Carolina.
Dr. Harry S. Mustard, Columbia University.
Dr. John Sundwall, University of Michigan.
Dr. W. L. Leathers, Vanderbilt University.
Dr. Gaylord Anderson, University of Minnesota.
Dr. Cecil K. Drinker, Harvard University.
Dr. Abel Wolman, Johns Hopkins University.

Dr. Ira V. Hiscock, Yale University.
Lt. Col. Arthur P. Hitchins, University of Pennsylvania.
Miss Katharine Tucker, University of Pennsylvania.

SUMMARY OF SYMPOSIUM ON ALCOHOLISM AVAILABLE

The April issue of Mental Hygiene will carry a brief report on the 3-day symposium conducted by the Research Council on Problems of Alcohol at Philadelphia, December 27–29, 1940. The symposium was part of the annual meeting of the American Association for the Advancement of Science.

Reprints of the report are now available from Mental Hygiene at nominal cost.

The report in Mental Hygiene discusses papers by Donald S. Berry, Dr. Norman Joliffe, Dr. Harold D. Palmer, Dr. Karl Bowman, Dr. Abraham Myerson, Dr. Jeremiah P. Shalloo, Dr. George S. Stevenson, Surgeon General Thomas Parran, and others.

The symposium was an approach to scientific description and control of individual and social problems of alcoholism.

MERCURIALISM AND ITS CONTROL IN THE FELT-HAT INDUSTRY [1]

Findings of the study of mercurialism in the felt-hat industry, conducted by the Public Health Service in cooperation with the Connecticut State Department of Health in 1940, are reported in Public Health Bulletin No. 263.

Fifty-nine cases of chronic mercurialism were found on medical examination of 534 hatters employed in five representative felt-hat factories. Four of the 21 men engaged in mixing and blowing, 8 of the 34 coners, 6 of the 29 hardeners, and 33 of the 179 starters, wetters-down, and sizers were so diagnosed. Mixers and blowers were exposed to 5 mg. Hg per 10 m.^{3} of air, hardeners to 2.7, and starters, wetters-down, and sizers to 2.1 mg. Hg per 10 m.^{3} of air. In any range of exposure above 1.0 mg. Hg per 10 m.^{3} the incidence of mercurialism increased with increasing duration of employment. No cases were found among hatters exposed to less than 1.0 mg. Hg per 10 m.^{3} of air, as measured by the Nordlander instrument.

Chronic mercurialism is characterized by fine intention tremor; psychic irritability of an exaggerated degree; dermographia, excessive perspiration, and abnormal readiness to blush; exaggerated tendon reflexes; pallor; and certain abnormalities of the mouth. Workers

[1] Mercurialism and its control in the felt-hat industry. Public Health Bulletin No. 263. Government Printing Office, Washington, 1941. Available from the Superintendent of Documents, Government Printing Office, at 15 cents per copy.

with mercurialism were found to excrete slightly less mercury in the urine than similarly exposed but nonaffected workers. Workers with elevated systolic blood pressure and albuminuria tended to excrete less mercury in the urine than similarly exposed workers who were normal in these respects.

The most direct means of preventing the occurrence of mercurialism among hatters is to substitute a nontoxic carroting agent for mercury. Until this is practicable, control of the mercury hazard depends on coordinated general and local exhaust ventilation so arranged and maintained as to prevent the escape of mercury into the breathing zone of workers, and upon enclosure or segregation of fur storage rooms, blowers, driers, and other sources of volatile mercury. Sketches of hoods and other enclosures, and specifications for air flow are presented.

Methods for quantitative chemical analysis of the mercury content of air, fur, tank water, etc., and for the quantitative spectrographic analysis of mercury in urine are described in detail.

COURT DECISION ON PUBLIC HEALTH

Statute regulating manufacture and distribution of confectionery products upheld.—(Washington Supreme Court; *Bauer et al.* v. *State et al.*, 110 P.2d 154; decided February 14, 1941.) A Washington statute, regulating the manufacture and distribution of candy and other confectionery products, excluded from its operation persons selling confections exclusively at retail in a fixed place of business. Another of the act's provisions was that no person should be permitted to work in a confectionery without holding a physician's certificate of health.

The plaintiffs, who were wholesale dealers in candy, instituted an action asking a declaratory judgment declaring the said law unconstitutional. As wholesale dealers the plaintiffs purchased candy from the manufacturer and sold it to retailers. They alleged that all of the candy in which they dealt was sold to them in boxes or cartons sealed with cellophane or wrapped in some other sanitary wrapping and that none of it was handled or sold by them in bulk or in any manner other than in the original containers in which it was received by them. They claimed that the act was unjustly discriminatory in that it affected them while exempting retail dealers who sold candy over the counter and who handled the candy in the course of arranging it for sale and selling it.

With reference to the plaintiffs' contention of denial of equal protection of the law in contravention of constitutional provisions, the Supreme Court of Washington quoted from one of its prior decisions in which it was said:

To comply with these constitutional provisions, legislation involving classifications must meet and satisfy two requirements: (1) The legislation must apply alike to all persons within the designated class; and (2) reasonable ground must exist for making a distinction between those who fall within the class and those who do not.

Within the limits of these restrictive rules, the Legislature has a wide measure of discretion, and its determination, when expressed in statutory enactment, cannot be successfully attacked unless it is manifestly arbitrary, unreasonable, inequitable, and unjust.

The court stated that the act in question in the instant case exempted no one within the designated class from its operation and could not be held unconstitutional because it applied to wholesalers or jobbers of confections and exempted from its operation persons selling such products at retail. It could be argued, said the court, that the latter class of persons should also be subject to statutory regulation but that was a matter within the legislative authority and it could not be held that the act was unconstitutional as containing a classification so unreasonable as to be beyond the power of the legislature.

The judgment of the lower court, which was adverse to the plaintiffs, was affirmed.

DEATHS DURING WEEK ENDED MARCH 15, 1941

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Mar. 15, 1941	Corresponding week, 1940
Data from 88 large cities of the United States:		
Total deaths	9,103	8,960
Average for 3 prior years	9,136	
Total deaths, first 11 weeks of year	105,855	105,008
Deaths under 1 year of age	521	428
Average for 3 prior years	516	
Deaths under 1 year of age, first 11 weeks of year	6,013	5,734
Data from industrial insurance companies:		
Policies in force	64,649,882	66,021,448
Number of death claims	12,836	13,652
Death claims per 1,000 policies in force, annual rate	10.4	10.8
Death claims per 1,000 policies, first 11 weeks of year, annual rate	10.9	10.7

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED MARCH 22, 1941

Summary

The number of reported cases of measles increased from 43,060 for the preceding week to 47,421 for the current week, a figure higher than recorded for the corresponding week in 1938 (44,191), when the largest number of cases for that year was reported. The cumulative figure for the current year (12 weeks) to date, however, is below that for the corresponding period of 1938—269,782 cases as compared with 374,502.

The current incidence of measles continues predominantly highest in the East North Central and Middle Atlantic States, with the South Atlantic and East South Central next. The current annual case rate in the East North Central area is nearly twice that for the country as a whole and approximately five to six times that for the New England and Western States. The lowest current incidence is reported for the Pacific States, which recorded the largest number of cases for the corresponding period in both 1939 and 1940 but the lowest in 1938.

For the current week each of the 9 communicable diseases listed in the following table, with the exception of measles and poliomyelitis, was below the 5-year (1936–40) median expectancy. Only 38 cases of smallpox were reported (26 in the North Central States and 5 in Washington State), and 76 cases of typhoid fever. Of 20 cases of endemic typhus fever, 7 were reported in Texas and 6 in Georgia. One case of Rocky Mountain spotted fever was reported in Nevada, 1 case of tularemia in Mississippi, and 1 case of psittacosis in Florida.

The death rate for the current week for 93 major cities in the United States was 12.6 per 1,000 population, as compared with 12.7 for both last week (92 cities) and the 3-year (1938–40) average (88 cities).

Telegraphic morbidity reports from State health officers for the week ended March 22, 1941, and comparison with corresponding week of 1940 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that, although none were reported, cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median 1936–40	Week ended—		Median 1936–40	Week ended—		Median 1936–40	Week ended—		Median 1936–40
	Mar. 22, 1941	Mar. 23, 1940		Mar. 22, 1941	Mar. 23, 1940		Mar. 22, 1941	Mar. 23, 1940		Mar. 22, 1941	Mar. 23, 1940	
NEW ENG.												
Maine	0	0	2	------	2	13	118	270	75	0	1	0
New Hampshire	0	0	0	3	------	------	89	93	11	0	0	0
Vermont	0	0	1	------	------	------	13	6	24	0	0	0
Massachusetts	1	3	3	------	------	------	700	386	782	4	0	4
Rhode Island	0	0	0	------	------	------	2	143	31	0	0	0
Connecticut	0	4	4	6	7	16	94	68	85	0	0	0
MID. ATL.												
New York [1]	19	19	34	[2] 32	[2] 28	[2] 32	7,892	479	1,615	[3] 3	5	8
New Jersey	10	2	10	29	11	12	2,772	167	193	2	1	1
Pennsylvania	21	13	30	------	------	------	5,149	149	333	4	5	6
E. NO. CEN.												
Ohio	6	4	16	68	14	13	7,691	9	238	1	0	4
Indiana	26	8	11	38	57	57	1,156	11	14	5	1	2
Illinois	17	23	33	53	16	47	4,159	104	81	1	3	3
Michigan [4]	1	2	10	19	1	6	3,275	289	245	0	5	4
Wisconsin	0	1	2	184	189	103	1,058	355	355	0	0	1
W. NO. CEN.												
Minnesota	0	0	2	3	2	2	12	214	214	0	1	1
Iowa	3	3	3	161	9	9	198	147	95	0	0	0
Missouri	9	3	12	201	8	144	384	6	26	3	0	2
North Dakota	0	2	1	8	62	6	27	3	5	0	0	0
South Dakota	0	1	0	1	2	------	3	2	2	0	0	0
Nebraska	2	2	2	11	------	------	9	15	85	0	0	1
Kansas	3	6	7	5	14	16	1,012	628	29	1	0	0
SO. ATL.												
Delaware	0	0	0	------	------	------	392	0	8	0	0	0
Maryland [4]	8	0	5	32	30	27	196	2	175	1	1	3
Dist. of Col.	2	13	13	2	2	2	287	1	37	1	1	1
Virginia	2	11	12	583	501	501	1,896	113	379	0	1	7
West Virginia [4]	6	6	10	72	229	165	360	12	19	2	7	5
North Carolina [1]	15	7	12	73	34	105	1,085	136	136	1	0	5
South Carolina	1	7	6	666	559	689	293	15	32	0	1	1
Georgia [1]	8	11	11	226	141	565	396	73	73	2	1	1
Florida [1] [5]	5	8	5	149	10	19	1,066	178	83	1	1	1
E. SO. CEN.												
Kentucky	3	6	8	90	38	79	1,111	137	137	3	5	5
Tennessee [1]	2	5	7	267	117	184	337	41	41	3	0	4
Alabama [1]	6	4	12	551	269	1,330	731	152	152	1	2	5
Mississippi [4]	3	7	6	------	------	------	------	------	------	1	0	0
W. SO. CEN.												
Arkansas	6	15	8	247	187	349	240	13	13	0	1	3
Louisiana [1]	3	8	11	7	14	64	120	0	9	3	2	2
Oklahoma	5	6	7	250	165	168	55	11	48	1	2	2
Texas [1]	30	37	38	1,361	1,277	1,166	1,416	800	418	1	1	5
MOUNTAIN												
Montana	2	13	1	2	4	7	9	20	60	0	1	0
Idaho	0	0	0	------	------	2	18	145	25	0	0	0
Wyoming	1	2	0	3	2	------	61	86	33	0	0	0
Colorado	5	9	9	18	23	------	266	19	19	0	0	0
New Mexico	1	0	4	15	11	1	143	14	54	1	1	2
Arizona	2	2	2	173	180	180	0	122	37	0	0	0
Utah [4]	1	2	2	22	15	1	13	718	127	1	0	0
Nevada [5]	0	------	------	6	------	------	10	------	------	0	------	------
PACIFIC												
Washington	5	1	1	8	------	16	89	1,026	278	1	0	0
Oregon	3	3	3	26	27	44	545	570	68	0	0	0
California	16	15	23	152	181	221	473	260	541	5	0	4
Total	259	289	404	5,823	4,438	6,359	47,421	8,208	10,885	53	50	75
12 weeks	3,492	4,668	6,360	562,145	144,942	100,056	269,782	67,982	91,852	[3] 570	478	1,084

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 22, 1941, and comparison with corresponding week of 1940 and 5-year median—Con.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever		
	Week ended—		Median 1936–40	Week ended—		Median 1936–40	Week ended—		Median 1936–40	Week ended—		Median 1936–40
	Mar. 22, 1941	Mar. 23, 1940		Mar. 22, 1941	Mar. 23, 1940		Mar. 22, 1941	Mar. 23, 1940		Mar. 22, 1941	Mar. 23, 1940	
NEW ENG.												
Maine	0	0	0	11	12	17	0	0	0	0	0	1
New Hampshire	0	0	0	2	1	4	0	0	0	1	0	0
Vermont	0	0	0	7	6	10	0	0	0	1	0	0
Massachusetts	1	0	0	153	141	269	0	0	0	0	0	1
Rhode Island	0	0	0	9	16	29	0	0	0	1	0	1
Connecticut	0	0	0	81	71	116	0	0	0	0	4	1
MID. ATL.												
New York [1]	[3] 0	0	0	553	1,190	1,028	0	0	0	1	3	8
New Jersey	0	0	0	381	390	225	0	0	0	0	3	1
Pennsylvania	0	1	1	371	377	522	0	0	0	5	3	7
E. NO. CEN.												
Ohio	0	1	1	319	225	339	1	5	5	3	3	3
Indiana	0	1	0	186	196	196	0	6	8	3	1	0
Illinois	0	0	2	520	833	779	7	2	19	1	4	4
Michigan [4]	0	3	0	155	287	508	2	1	12	0	5	2
Wisconsin	0	1	1	144	134	201	1	0	5	0	1	1
W. NO. CEN.												
Minnesota	1	0	0	47	82	100	3	5	7	0	0	0
Iowa	0	0	1	69	45	224	4	13	27	1	1	1
Missouri	0	0	0	228	47	211	6	8	22	2	3	3
North Dakota	3	0	0	3	16	22	2	1	4	0	1	0
South Dakota	1	0	0	24	18	18	0	4	4	0	1	0
Nebraska	0	0	0	27	15	41	0	0	7	0	0	0
Kansas	0	1	0	55	64	148	0	1	22	1	2	1
SO. ATL.												
Delaware	0	0	0	14	16	9	0	0	0	0	0	0
Maryland [4]	0	0	0	55	39	39	0	0	0	0	1	2
Dist. of Col.	0	0	0	23	37	19	0	0	0	1	1	0
Virginia	0	1	0	43	40	30	0	0	0	3	4	4
West Virginia [4]	0	1	0	46	46	46	0	1	0	0	2	3
North Carolina [1]	0	0	0	25	39	39	0	0	0	0	2	2
South Carolina	0	0	0	8	1	4	1	0	0	3	0	2
Georgia [1]	0	1	1	15	18	18	0	0	0	3	1	2
Florida [1] [5]	6	0	0	8	15	8	0	0	0	6	2	2
E. SO. CEN.												
Kentucky	2	3	1	133	105	90	0	0	0	1	4	2
Tennessee [1]	0	0	0	105	93	37	1	0	0	1	2	2
Alabama [1]	1	0	1	16	9	11	1	1	1	2	2	2
Mississippi [4]	0	0	0	2	2	7	0	0	0	2	6	1
W. SO. CEN.												
Arkansas	0	2	1	6	6	10	0	3	3	3	0	0
Louisiana [1]	0	0	0	8	15	13	0	0	0	0	3	5
Oklahoma	2	2	1	30	20	24	0	1	2	5	1	1
Texas [1]	1	1	1	74	49	83	2	6	7	7	11	11
MOUNTAIN												
Montana	3	2	0	22	21	21	0	0	10	0	1	0
Idaho	0	0	0	5	3	15	1	0	2	0	0	0
Wyoming	0	0	0	9	7	16	1	1	0	1	1	1
Colorado	0	0	0	46	37	46	0	6	3	6	0	0
New Mexico	0	1	0	6	3	28	0	0	0	4	1	1
Arizona	0	2	0	5	13	13	0	0	0	1	0	0
Utah [4]	0	0	0	22	15	21	0	0	1	0	0	0
Nevada [6]	0	----	----	0	----	----	0	----	----	0	----	----
PACIFIC												
Washington	0	0	0	34	47	46	5	1	6	3	2	2
Oregon	1	1	1	6	18	43	0	2	14	1	4	2
California	2	3	0	177	138	202	0	4	14	3	3	2
Total	24	28	18	4,288	5,018	6,209	38	72	272	76	89	110
12 weeks	[3] 332	335	248	42,770	56,107	73,614	560	882	3,654	909	916	1,308

See footnotes at end of table.

Telegraphic morbidity reports from State health officers for the week ended March 22, 1941, and comparison with corresponding week of 1940 and 5-year median—Con.

Division and State	Whooping cough	
	Week ended—	
	Mar. 22, 1941	Mar. 23, 1940
NEW ENG.		
Maine	36	84
New Hampshire	3	15
Vermont	5	38
Massachusetts	189	104
Rhode Island	14	2
Connecticut	59	23
MID. ATL.		
New York [1]	294	382
New Jersey	93	65
Pennsylvania	373	263
E. NO. CEN.		
Ohio	307	76
Indiana	37	44
Illinois	86	114
Michigan [4]	199	129
Wisconsin	101	84
W. NO. CEN.		
Minnesota	74	22
Iowa	64	1
Missouri	90	27
North Dakota	17	1
South Dakota	10	2
Nebraska	32	4
Kansas	136	39
SO. ATL.		
Delaware	6	14
Maryland [4]	94	253
Dist. of Col	7	14
Virginia	98	40
West Virginia [4]	46	27
North Carolina [1]	271	77
SO. ATL.—continued		
South Carolina	116	26
Georgia [1]	18	14
Florida [1] [5]	15	21
E. SO. CEN.		
Kentucky	74	53
Tennessee [1]	30	29
Alabama [1]	37	4
Mississippi [4]	------	------
W. SO. CEN.		
Arkansas	20	7
Louisiana [1]	13	1
Oklahoma	45	8
Texas [1]	233	255
MOUNTAIN		
Montana	31	2
Idaho	9	11
Wyoming	0	0
Colorado	85	6
New Mexico	15	12
Arizona	42	25
Utah [4]	86	200
Nevada [6]	0	------
PACIFIC		
Washington	93	72
Oregon	18	39
California	465	205
Total	4,186	2,934
12 weeks	50,999	34,738

[1] Typhus fever, week ended Mar. 22, 1941, 22 cases, as follows: New York, 2; North Carolina, 2; Georgia, 6; Florida, 1; Tennessee, 1; Alabama, 2; Louisiana, 1; Texas, 7.

[2] New York City only.

[3] Information has recently been received that the weekly reports of meningococcus meningitis in the State of New York should include, in addition to the figures published, cases reported in New York City for 10 consecutive weeks ended Mar. 8, 1941, in order, as follows: 2, 3, 2, 2, 1, 3, 2, 1, 1, and 1; also, that the number of poliomyelitis cases in New York for the week ended Jan. 4, Public Health Reports, Jan. 10, 1941, p. 78, should be 2 instead of 11.

[4] Period ended earlier than Saturday.

[5] Psittacosis, week ended Mar. 22, 1941, Florida, 1 case.

[6] Rocky Mountain spotted fever, week ended Mar. 22, 1941, Nevada, 1 case.

WEEKLY REPORTS FROM CITIES

City reports for week ended March 8,1941

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	134	806	129	5,725	890	2,154	27	390	21	1,141	------
Current week [1]	63	461	63	15,164	495	1,260	0	308	23	1,201	------
Maine:											
Portland	0	------	0	0	2	0	0	0	0	19	23
New Hampshire:											
Concord	0	------	0	0	0	0	0	1	0	0	10
Manchester	0	------	1	0	1	4	0	1	0	0	18
Nashua	0	------	0	0	0	0	0	0	0	7	5
Vermont:											
Barre	------	------	------	------	------	------	------	------	------	------	------
Burlington	0	------	0	0	0	0	0	0	0	0	9
Rutland	0	------	1	0	0	0	0	0	0	0	6
Massachusetts:											
Boston	1	------	1	180	13	49	0	14	0	53	228
Fall River	0	------	0	0	0	6	0	0	0	3	28
Springfield	0	------	0	1	1	6	0	1	0	0	32
Worcester	0	------	0	74	4	6	0	2	0	4	59
Rhode Island:											
Pawtucket	0	------	0	0	0	1	0	0	0	0	14
Providence	0	1	0	0	2	3	0	2	0	12	61
Connecticut:											
Bridgeport	0	1	1	4	1	3	0	0	0	6	28
Hartford	1	------	0	1	1	0	0	1	0	8	43
New Haven	0	1	0	1	3	20	0	0	0	5	36
New York:											
Buffalo	0	------	2	30	14	25	0	6	1	18	168
New York	25	59	2	5,290	94	233	0	56	2	113	1,589
Rochester	0	------	0	22	2	4	0	1	0	17	72
Syracuse	0	------	0	0	2	1	0	2	0	30	50
New Jersey:											
Camden	1	------	0	20	3	10	0	0	0	7	26
Newark	0	9	1	257	8	34	0	5	0	2	118
Trenton	1	1	0	31	2	54	0	2	0	0	37
Pennsylvania:											
Philadelphia	2	7	3	1,399	42	90	0	19	2	52	522
Pittsburgh	4	2	1	61	11	11	0	8	0	52	177
Reading	0	------	0	282	0	3	0	2	0	2	23
Scranton	0	------	0	2	0	0	0	0	0	0	------
Ohio:											
Cincinnati	2	------	2	191	5	23	0	5	0	3	126
Cleveland	0	21	2	2,527	5	37	0	6	0	92	184
Columbus	0	2	2	53	4	16	0	3	0	22	74
Toledo	0	------	0	36	5	1	0	9	0	5	95
Indiana:											
Anderson	0	------	0	0	4	0	0	1	0	0	16
Fort Wayne	0	------	0	34	2	2	0	0	0	0	23
Indianapolis	2	------	4	96	12	24	0	5	0	9	109
Muncie	0	------	0	6	2	20	0	0	1	0	7
South Bend	0	------	0	19	1	0	0	0	0	0	12
Terre Haute	0	------	0	3	2	0	0	0	0	0	12
Illinois:											
Alton	1	------	0	0	1	11	0	0	0	1	14
Chicago	2	10	3	1,798	37	171	0	40	1	39	715
Elgin	0	------	0	185	0	1	0	0	0	0	11
Moline	0	------	0	3	0	3	0	0	0	2	12
Springfield	1	------	0	0	1	7	0	0	0	5	20
Michigan:											
Detroit	4	7	3	1,264	16	131	0	17	0	124	312
Flint	0	------	0	79	3	3	0	1	0	8	22
Grand Rapids	1	------	0	196	3	7	0	0	0	6	41
Wisconsin:											
Kenosha	0	------	1	48	0	1	0	0	0	0	8
Madison	0	------	0	13	0	6	0	0	0	2	23
Milwaukee	0	------	0	68	13	21	0	2	0	35	127
Racine	0	------	0	7	0	5	0	0	0	8	13
Superior	0	------	0	0	0	3	0	0	0	0	6
Minnesota:											
Duluth	0	------	0	1	1	2	0	0	0	22	25
Minneapolis	1	7	0	2	1	17	0	0	0	33	110
St. Paul	0	------	0	0	2	8	0	0	0	24	74

[1] Figures for Barre and Tampa estimated; reports not received.

City reports for week ended March 8, 1941—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Iowa:											
Cedar Rapids	0			0		1	0		0	0	
Davenport	0			1		3	0		0	0	
Des Moines	0			0		6	0		0	2	44
Sioux City	0			0		0	0		0	0	
Waterloo	0			18		3	0		0	3	
Missouri:											
Kansas City	0		1	2	9	5	0	6	0	24	92
St. Joseph	0		0	2	3	0	0	0	0	1	32
St. Louis	1		0	68	5	55	0	4	0	21	182
North Dakota:											
Fargo	0			1		1	0		0	16	
Grand Forks	0			0		0	0		0	0	
Minot	1			0		0	0		0	3	8
South Dakota:											
Aberdeen	0			1		1	0			3	
Nebraska:											
Lincoln	0			0		7	0		0	0	
Omaha	0		0	2	1	1	0	3	0	1	62
Kansas:											
Lawrence	0			33		1	0		0	4	6
Topeka	0		0	59	3	2	0	0	0	17	6
Wichita	0	2	0	5	5	1	0	0	1	22	31
Delaware:											
Wilmington	1		0	218	4	0	0	2	0	3	34
Maryland:											
Baltimore	1	14	3	40	35	23	0	12	0	49	290
Cumberland	0		0	0	1	0	0	0	0	0	15
Frederick	0		0	0	0	0	0	0	0	0	8
Dist. of Col.:											
Washington	0	46	6	89	25	26	0	8	1	6	198
Virginia:											
Lynchburg	0		0	2	0	0	0	1	0	0	6
Norfolk	0	130	0	29	2	3	0	2	1	5	37
Richmond	0		2	24	8	1	0	1	0	0	65
Roanoke	1		0	122	2	0	0	0	0	5	15
West Virginia:											
Charleston	0		0	44	11	1	0	0	0	0	50
Wheeling	0		0	3	4	0	0	1	0	6	20
North Carolina:											
Gastonia	0			6		0	0		0	1	
Raleigh	0		0	134	2	0	0	1	0	10	6
Wilmington	0		0	3	2	0	0	0	0	3	12
Winston-Salem	0	2	0	4	1	2	0	0	0	16	12
South Carolina:											
Charleston	0	44	1	10	1	2	0	0	9	1	22
Florence	0	6	0	11	3	0	0	1	0	2	12
Georgia:											
Atlanta	0	5	0	42	5	2	0	5	0	2	93
Brunswick	0		0	0	0	0	0	0	0	0	2
Savannah	0	32	4	4	3	1	0	0	0	0	44
Florida:											
Miami	0	8	0	10	2	2	0	1	0	3	56
Tampa											
Kentucky:											
Ashland	0		0	0	1	0	0	0	0	0	7
Covington	0	1	0	18	0	1	0	0	0	1	9
Lexington	0		0	3	4	1	0	2	0	1	19
Louisville	0	2	1	173	9	69	0	6	0	10	81
Tennessee:											
Knoxville	0		0	28	3	8	0	3	0	4	36
Memphis	0	12	2	87	3	5	0	3	0	18	82
Nashville	0		0	19	5	10	0	0	0	8	62
Alabama:											
Birmingham	0	18	0	21	8	4	0	3	3	5	93
Mobile	1	12	0	6	3	0	0	0	0	0	
Montgomery	2	26		0		1	0		0	1	
Arkansas:											
Fort Smith	0			4		0	0		0	0	
Little Rock	0		2	3	3	1	0	0	0	0	25
Louisiana:											
Lake Charles	0		0	1	0	0	0	0	0	0	5
New Orleans	0	5	4	7	7	2	0	8	0	1	147
Shreveport	0		0	0	2	2	0	2	0	1	32

City reports for week ended March 8, 1941—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Oklahoma:											
Oklahoma City	0	18	0	1	2	3	4	2	0	2	46
Tulsa	0	-----	0	1	5	1	0	1	0	6	29
Texas:											
Dallas	4	1	1	5	5	14	0	1	0	1	61
Fort Worth	0	-----	2	156	3	0	0	1	0	8	45
Galveston	0	-----	0	0	1	2	0	0	0	0	14
Houston	0	1	0	1	8	2	0	4	1	0	92
San Antonio	0	6	5	0	3	1	0	13	0	5	68
Montana:											
Billings	0	-----	0	1	1	0	0	0	0	0	5
Great Falls	0	-----	0	0	2	10	0	0	0	0	12
Helena	0	-----	0	0	0	0	0	0	0	2	4
Missoula	0	-----	0	0	1	2	0	0	0	0	4
Idaho:											
Boise	0	-----	0	1	1	1	0	0	0	0	6
Colorado:											
Colorado Springs	1	-----	1	1	0	5	0	-----	0	0	10
Denver	5	19	1	85	1	7	0	1	0	29	78
Pueblo	0	-----	0	1	1	5	0	0	0	2	8
New Mexico:											
Albuquerque	0	-----	0	6	0	0	0	0	0	0	1
Utah:											
Salt Lake City	0	-----	-----	1	-----	0	0	-----	1	9	29
Washington:											
Seattle	0	-----	2	3	3	4	0	6	0	4	89
Spokane	0	1	1	7	2	2	0	1	0	1	30
Tacoma	0	-----	0	0	4	0	0	2	0	4	28
Oregon:											
Portland	1	4	0	24	1	2	0	1	0	0	71
Salem	0	-----	-----	3	-----	0	0	-----	0	0	-----
California:											
Los Angeles	1	36	3	32	2	30	0	18	1	34	379
Sacramento	0	3	0	2	1	3	0	0	0	4	28
San Francisco	1	98	0	6	6	7	0	13	0	46	184

State and city	Meningitis, meningococcus		Poliomyelitis cases	State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths			Cases	Deaths	
Rhode Island:				District of Columbia:			
Providence	0	1	0	Washington	1	1	0
New York:				West Virginia:			
New York	1	0	0	Wheeling	0	1	0
Pennsylvania:				South Carolina:			
Scranton	1	1	0	Charleston	1	0	0
Ohio:				Florence	0	1	0
Cincinnati	1	0	0	Florida:			
Cleveland	1	0	0	Miami	0	0	2
Indiana:				Alabama:			
Indianapolis	0	1	0	Birmingham	1	1	0
Michigan:				Idaho:			
Detroit	1	0	0	Boise	1	0	0
Minnesota:				California:			
Minneapolis	1	0	0	Los Angeles	1	1	0
Maryland:							
Baltimore	2	0	0				

Encephalitis, epidemic or lethargic.—Cases: Springfield, Mass., 2; Buffalo, 1; New York, 1; Pittsburgh, 1; Columbus, 1; Topeka, 1. Deaths: New York, 1; Columbus, 1; Topeka, 1.
Pellagra.—Cases: Charleston, S. C., 2; Atlanta, 1; Savannah, 2; Sacramento, 1.
Rabies in man.—Deaths: Cincinnati, 1; Atlanta, 1.
Typhus fever.—Cases: New York, 1; Miami, 1.

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended February 15, 1941.—During the week ended February 15, 1941, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis		3	3	6	9	2	2	5	4	34
Chickenpox		2		101	400	31	30	33	79	676
Diphtheria		14		11	5	2	2	2		36
Dysentery				2						2
Influenza		14			15	8			28	65
Lethargic encephalitis									1	1
Measles		226	135	241	1,090	147	381	328	800	3,348
Mumps				125	167	18	23	17	46	396
Pneumonia		20			19				8	47
Scarlet fever		44	3	119	174	9	3	10	13	375
Trachoma							1			1
Tuberculosis	1	8	15	79	52	2	14	1		172
Typhoid and paratyphoid fever				10	3					13
Whooping cough		1		158	167	37	19	9	12	403

CUBA

Habana—Communicable diseases—4 weeks ended March 8, 1941.—During the 4 weeks ended March 8, 1941, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	10	1	Scarlet fever	1	
Leprosy		2	Tuberculosis		2
Malaria	1		Typhoid fever	35	

DENMARK

Notifiable diseases—October–December 1940.—During the months of October, November, and December 1940, cases of certain notifiable diseases were reported in Denmark as follows:

Disease	October	November	December	Disease	October	November	December
Cerebrospinal meningitis	4	2	8	Measles	2,537	3,203	2,946
Chickenpox	812	1,391	1,257	Mumps	86	118	147
Diphtheria	69	54	52	Paratyphoid fever	3	1	3
Dysentery	60	20	27	Puerperal fever	20	18	12
Epidemic encephalitis	2	3		Scarlet fever	805	704	492
Erysipelas	298	276	250	Syphilis	55	44	39
Gastroenteritis, acute	2,190	2,312	1,925	Tetanus, neonatorum	8	4	
German measles	244	347	369	Typhoid fever	3		4
Gonorrhea	819	759	618	Undulant fever	56	49	36
Influenza	4,140	5,191	6,244	Weil's disease	2	6	3
Malaria			1	Whooping cough	2,361	2,590	2,300

YUGOSLAVIA

Notifiable diseases—4 weeks ended January 26, 1941.—During the 4 weeks ended January 26, 1941, certain notifiable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax	4	2	Paratyphoid fever	9	----
Cerebrospinal meningitis	212	48	Poliomyelitis	1	----
Diphtheria and croup	357	42	Scarlet fever	199	4
Dysentery	33	6	Sepsis	8	3
Erysipelas	101	3	Tetanus	13	4
Favus	10	----	Typhoid fever	246	38
Lethargic encephalitis	2	----	Typhus fever	18	----

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From medical officers of the Public Health Service, American consuls, International Office of Public Health, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following tables must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

CHOLERA

[C indicates cases; D, deaths]

NOTE.—Since many of the figures in the following tables are from weekly reports, the accumulated totals are for approximate dates.

Place		January–December 1940	January 1941	February 1941—week ended—			
				1	8	15	22
ASIA							
Ceylon	C	1	----	----	----	----	----
China:[1]							
Dairen	C	2	----	----	----	----	----
Foochow	C	625	----	----	----	----	----
Hong Kong	C	867	5	1	----	----	----
Macao	C	513	----	----	----	----	----
Manchuria	C	31	----	----	----	----	----
Shanghai	C	571	----	----	----	----	----
Shantung Province	C	244	----	----	----	----	----
India	C	[2] 43,094	----	----	----	----	----
Bassein	C	164	----	----	----	----	----
Bombay	C	13	----	----	----	----	----
Calcutta	C	2,434	68	----	----	----	----
Cawnpore	C	333	----	----	----	----	----
Chittagong	C	4	----	----	----	----	----
Karachi	C	65	----	----	----	----	----
Madras	C	1	----	----	----	----	----
Moulmein	C	16	----	----	----	----	----
Porto Novo	C	1	----	----	----	----	----
Rangoon	C	61	----	----	----	----	----
Vizagapatam	C	21	----	----	----	----	----
India (French)	C	34	----	----	----	----	----
Indochina (French)	C	436	----	----	----	----	----
Thailand	C	235	----	----	----	----	----

[1] From the middle of June to the end of August 1940, 41,181 deaths from cholera were reported in China.
[2] January to August 10, 1940.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

PLAGUE

[C indicates cases; D, deaths]

Place		January–December 1940	January 1941	February 1941—week ended—			
				1	8	15	22
AFRICA							
Algeria	C	23					
Plague-infected rats		2					
Belgian Congo	C	26		1			
British East Africa:							
Kenya	C	9					
Uganda	C	277					
Egypt	C	[1] 409					
Madagascar	C	598	51		21	22	9
Morocco	C	1,099	146	64	88	45	32
Rhodesia, Northern	C	1					
Senegal:							
Dakar	D	[2] 1					
Thies	C	1					
Tivaouane	C	3					
Tunisia: **Tunis**	C	10	2				
Plague-infected rats		1					
Union of South Africa	C	[3] 37	8				
ASIA							
China: [4]							
Dutch East Indies;							
Java and Madura	C	378					
West Java	C	8					
India	C	[5] 14,438					
Bassein	C	18					
Cochin	C	1					
Plague-infected rats		5					
Rangoon	C	6		1			
Indochina (French)	C	5					
Thailand:							
Bangkok	C	3					
Plague-infected rats		2					
Bisnulok Province	C	3					
Chingmai	C	3					
Dhonpuri Province	C	1					
Jayanad Province	C	3					
Kamphaeng Bajr Province	C	29					
Kanchanapuri Province	C	12					
Koan Kaen Province	C	5					
Nagara Svarga Province	C	30					
Noangkhay Province	C	4					
Sukhodaya Province	C	22					
EUROPE							
Portugal: Azores Islands	C	3					
SOUTH AMERICA							
Argentina:							
Catamarca Province	C	10					
Cordoba Province	C	[6] 54	1				
Jujuy Province	C	9					
La Pampa Territory	C	1					
La Rioja Province	C	1					
Salta Province	C	8					
San Luis Province	C	2					
Santiago del Estero Province	C	85					
Tucuman Province	C	21					

[1] Includes 5 cases of pneumonic plague.
[2] Imported.
[3] Includes 6 cases of pneumonic plague.
[4] Information dated July 7 states that up to July 6, 17 cases of plague had been reported near Tungliao, Hsingan Province, China; and a report dated July 13 states that an outbreak of bubonic plague occurred along the Yunnan-Burma border in the districts of Loiwing, Chefang, Juili, and Muchieh. Information dated Aug. 17 states that 45 cases of plague with 36 deaths have occurred in Nungen District and a telegram dated Oct. 2 states that 15 cases of bubonic plague with 3 deaths occurred in Hsinking, Manchuria. During the week ended Nov. 16, 1940, an epidemic of bubonic plague was reported in Ningpo District, Chekiang Province, China.
[5] January to August 10, 1940.
[6] Includes 15 cases of pneumonic plague.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER AND YELLOW FEVER—Continued

PLAGUE—Continued

[C indicates cases; D, deaths]

Place		January–December 1940	January 1941	February 1941—week ended—			
				1	8	15	22
SOUTH AMERICA—continued							
Brazil:							
Alagoas State	C	9					
Pernambuco State	C	4					
Ecuador: El Oro Province	C	6					
Peru:							
Cajabamba Department	C	1					
Cajamarca Department	C	28					
Lambayeque Department	C	15					
Libertad Department	C	53					
Lima Department	C	57					
Piura Department	C	9					
Tumbes Department	C	[7] 21					
OCEANIA							
Hawaii Territory: Plague-infected rats		[8] 54	2		2	2	1
New Caledonia	C		7				

[7] Includes 3 suspected cases.
[8] During the week ended Dec. 7, a positive mass inoculation of 12 rats and 1 mouse was also reported.

SMALLPOX

AFRICA							
Algeria	C	6	3		8	12	
Angola	C	271					
Belgian Congo	C	4,765					
British East Africa	C	59					
Dahomey	C	89	134		19	86	31
French Guinea	C	16	11				
Gibraltar	C	[1] 1					
Ivory Coast	C	132	8		6		1
Morocco	C	103					
Nigeria	C	2,319	74	9			
Niger Territory	C	664	9		5	6	32
Nyasaland	C	75					
Portuguese East Africa	C	1					
Rhodesia:							
Northern	C	6					
Southern	C	259	20				
Senegal	C	160	16		1	1	
Sierra Leone	C	10					
Sudan (Anglo-Egyptian)	C	535	1				
Sudan (French)	C	3				5	5
Union of South Africa	C	180					
ASIA							
Arabia	C	255					
China	C	958	18		14	5	1
Chosen	C	720					
Dutch East Indies—Sabang	C	4					
India	C	[3] 154,740					
India (French)	C	5					
India (Portuguese)	C	20					
Indochina (French)	C	1,571	42		38		75
Iran	C	177	4				
Iraq	C	935	149		65		
Japan	C	502	41			[2] 80	
Straits Settlements	C	1					
Sumatra	C	1					
Thailand	C	209	40	11	8		1
EUROPE							
France	C	[4] 4				1	
Great Britain	C	2					
Greece	C	23					
Portugal	C	504					
Spain	C	1,090	55	3			
Turkey	C	139					

[1] Imported.
[3] January to August 10, 1940
[2] For 3 weeks.
[4] For the month of June 1940.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER AND YELLOW FEVER—Continued

SMALLPOX—Continued

[C indicates cases; D, deaths]

Place		January–December 1940	January 1941	February 1941—week ended—			
				1	8	15	22
NORTH AMERICA							
Canada	C	17	.....	1	.....	.....	.....
Guatemala	C	35	.....	.....	.....	.....	.....
Mexico	C	55	.....	.....	.....	.....	.....
SOUTH AMERICA							
Bolivia	C	352	.....	.....	.....	.....	.....
Brazil	C	3	.....	.....	.....	.....	.....
Colombia	C	1,990	1	2	.....	.....	.....
Ecuador	C	1	.....	.....	.....	.....	.....
Peru	C	212	.....	.....	.....	.....	.....
Venezuela (alastrim)	C	224	21	.....	.....	6	.....

TYPHUS FEVER

AFRICA							
Algeria	C	2,146	224	.....	154	198	.....
Belgian Congo	C	1,210	.....	.....	.....	.....	.....
British East Africa	C	2	.....	.....	.....	.....	.....
Egypt	C	3,636	.....	.....	.....	.....	.....
Eritrea	C	63	.....	.....	.....	.....	.....
Morocco	C	355	5	1	.....	9	14
Rhodesia, Northern	C	7	.....	.....	.....	.....	.....
Tunisia	C	651	150	.....	35	75	92
Union of South Africa	C	298	.....	.....	.....	.....	.....
ASIA							
China	C	2,191	.....	.....	.....	.....	.....
Chosen	C	359	.....	.....	.....	.....	.....
India	C	3	.....	.....	.....	.....	.....
Indochina (French)	C	2	.....	.....	.....	.....	.....
Iran	C	256	1	.....	.....	.....	.....
Iraq	C	159	2	.....	1	.....	.....
Japan	C	2	.....	.....	.....	.....	.....
Palestine	C	203	.....	.....	.....	.....	.....
Straits Settlements	C	15	2	.....	.....	.....	.....
Sumatra	C	[1] 196	.....	.....	.....	.....	.....
Trans-Jordan	C	15	.....	.....	.....	.....	.....
EUROPE							
Bulgaria	C	155	10	10	.....	9	10
France	C	1	.....	.....	.....	.....	.....
Germany	C	230	71	.....	.....	25	.....
Greece	C	43	2	5	.....	.....	.....
Hungary	C	93	31	.....	.....	9	.....
Irish Free State	C	10	1	.....	.....	.....	.....
Lithuania	C	115	.....	.....	.....	.....	.....
Rumania	C	1,403	112	56	60	69	40
Spain	C	14	.....	3	.....	.....	.....
Turkey	C	533	.....	.....	.....	.....	.....
Yugoslavia	C	282	18	6	.....	.....	.....
NORTH AMERICA							
Guatemala	C	309	43	.....	.....	.....	.....
Mexico	C	215	.....	.....	.....	.....	.....
Panama Canal Zone	C	3	.....	.....	.....	.....	.....
Salvador	C	1	.....	.....	.....	.....	.....
SOUTH AMERICA							
Bolivia	C	733	.....	.....	.....	.....	.....
Chile	C	427	.....	.....	.....	.....	.....
Ecuador	C	2	16	.....	.....	.....	.....
Peru	C	988	.....	.....	.....	.....	.....
Venezuela	C	14	6	.....	.....	4	.....
OCEANIA							
Australia	C	12	3	.....	.....	.....	.....
Hawaii Territory	C	28	2	.....	.....	.....	.....

[1] For the period May to August 1940, inclusive.

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER AND YELLOW FEVER—Continued

YELLOW FEVER

[C indicates cases; D, deaths]

Place		January–December 1940	January 1941	February 1941—week ended—			
				1	8	15	22
AFRICA							
Belgian Congo: Yatolet	C	1					
Cameroon: Nkongsamba	C	[1] 1					
French Equatorial Africa: Fort Archambault	C	[1] 1					
Gold Coast	C	1					
Ivory Coast	C	[2] 6	[1] 1				2
Nigeria:							
Ibadan	C	1					
Oshogbo	C	[1] 1					
Sudan (Anglo-Egyptian): Kordofan Province [3]	C	858					
Sudan (French): Segou	C	[1] 1					
Togo (French)	C	1					
SOUTH AMERICA							
Bolivia: Beni Department	C	1					
Brazil:							
Bahia State	D	1					
Espirito Santo State	D	140					
Minas Geraes State	D	2					
Para State	D	1					
Rio de Janeiro State	D	5					
Santa Catarina State	D	2					
Colombia:							
Antioquia Department—San Luis	D	2					
Boyaca Department	D		3				
Caldas Department—							
La Pradera	D	1					
Samana	D	1					
Victoria	D	1					
Cundinamarca Department	D	2					
Intendencias and Commissaries	C	5					
Meta Department	D	7	1				
Municipality of Jesus Maria	D	1					
Santander Department	D	3	2				
Tolima Department	D	12	1				

[1] Suspected.
[2] Includes 4 suspected cases.
[3] A report dated Nov. 13, 1940, also states that 8,000 cases of yellow fever with 800 deaths have been reported in Kordofan Province, Anglo-Egyptian Sudan.